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Cover photograph: Windermere grazing (Photo: T. Parker)

Intensive Rations for Laying Hens

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With the changes in the relative prices and availability of feedingstuffs, and the acquisition of more knowledge on the subject, it is becoming apparent that even a laying ration found reliable from long experience may not be the most economical now. The author suggests ways of calculating alternative and more profitable rations.

Most of the difference, in cost per ton, between a balanced laying ration on the one hand, and the common cereal grains on the other arises from the relative deficiency of the latter in protein. Once the bird's requirement for protein is satisfied, there is no advantage to be gained from a higher level. However, there is no single protein level that can be considered correct for every type of laying ration. The level depends both on the quality of the protein and on the average daily intake of feed by a hen under standard conditions. This last factor is one of the most important in deciding which of two formulae is the most truly economical.

A laying hen seems instinctively to eat an amount of food that will provide just the number of calories she needs. Differences in the energy content of rations have been the subject of discussion recently in connection with the use of surplus fats as a supplement. However, even without added fat, diets may vary by 20–25 per cent in their energy content, and thus in the weight of feed that a hen needs and will in fact consume.

There are special difficulties about expressing the relative energy values of different foods. Ordinary starch equivalent figures are applicable only to ruminant animals which make better use of roughages. American workers have used a table of productive energy values for poultry calculations, but these values have not proved reproducible in other experiments. Opinion now favours the use of metabolizable energy values[1]. A summary of values for the most common ingredients is given in Table 1, but only the first ten figures were obtained by direct experiment in this country[2].

Table 1

Approximate Metabolizable Energy Values of Common Feedingstuffs
(Metabolizable Therms per 100 lb)

Maize	159	Grassmeal	30
Sorghum	154	Pea and bean meal	85
Wheat	151	D.E. groundnut meal	110
Barley	126	Soyabean meal	110
Oats	123	White fishmeal	90
Wheat Offals (5·5%)*	120	Herring meal	100
„ „ (10·6%)*	60	Whale meat meal	100
„ „ (7·6%)*	91	Meat-and-bone meal	80
Maize gluten feed	87	Stabilized tallow	325

* The grades of wheat offals are characterized by their crude fibre content, since their nomenclature is inconsistent.

The energy values are expressed here as Therms per 100 lb. Values are sometimes expressed as Calories per kilogram, but since 1 Therm equals 1,000 Calories and 1 kilogram is approximately 2·2 lb, the metric figures can be divided by 22 for conversion to the British units. The values given here also refer to samples with 10 per cent moisture content, and it should be remembered that other tables may refer to a different standard, or even to the weight of dry matter in the feed. Since water has no energy value, the true figure for any particular batch is proportional to its dry matter content, and correction must be made according to the known or estimated value. In general, home-grown grains are more diluted with water than imported material. Lastly, if only a figure for the "productive energy" value of a particular feedingstuff can be found, multiplication of this by 1·42 will give the best estimate of its metabolizable energy.

It used to be thought that millers' offals were essential to a well-balanced laying ration, and that there were restrictions as to the level of individual cereals that could be used. Results obtained in different parts of the world have shown that this is not the case. Any of the common cereals, in appropriate condition, can be included at a high level without harm, and there is little difference in the level and quality of the protein that they contain. Their value is therefore roughly proportional to their energy content. Wheat offals are very variable and, even allowing for their higher protein content, their price is usually too high to justify inclusion in a diet, unless they are known to be of the highest quality. Hens can be allowed to feed *ad lib.* on a balanced mash, since experiments have shown no advantage from restricted feeding.

Protein levels and quality

Protein cannot be given as a fixed daily ration, but must be included in the mash at a level where experience shows that it will provide for the hen's requirements. It is generally assumed that the protein requirement will rise with the level of production, but, as yet, experiments have failed to demonstrate this clearly. Since there is negligible storage of a temporary excess of protein, and in any one day a hen can only lay one egg, perhaps we should not even expect to find the effect.

As a working standard, I suggest 0·11 lb protein (of average quality) per metabolizable Therm (M.T.). In different units* this is very close to the recommendation of the experienced Cornell University group[3]. Converting to the more familiar percentages, it means having 15 per cent protein in a high-energy ration (1·36 M.T. per lb) and 12 per cent protein in a low-energy ration (1·09 M.T. per lb).

Although such calculations may seem unfamiliar, they are exactly comparable to the calculation of the nutritive ratio of starch equivalent and protein equivalent in cattle rations. In the past, restricted ideas about the possible cereal combinations meant that all laying rations were similar, so

* The American literature makes recommendation as to the "Calorie-Protein (or C-P) ratio" of rations. This is defined as the productive energy (in Calories per lb) divided by the percentage of protein in the diet. From the conversion factors already given one finds that "lb protein per M. Therm" is approximately "710÷C-P ratio"; so that the present standard corresponds to a C-P ratio of about 64.

that it was reasonable to express dietary requirements as simple percentages. It has, however, been found that British results are much more in accord with U.S. standards when account is taken of the lower energy level of the diets used for our birds[4,5,6]. That is to say, results have shown that our low-energy type of diet needs less than the 15 per cent protein content recommended by American workers from their experience with high-energy diets.

The level of crude protein, or albuminoids, in a feed means simply the nitrogen content multiplied by 6·25 (this is done because, on the average, a little less than one-sixth of the weight of pure protein is nitrogen). Even urea and ammonium sulphate would be analysed as crude protein although they are of no nutritional value. The addition of such chemicals could only come from deliberate fraud, but the analysis can still be misleading when applied to mixtures of ordinary feedingstuffs.

One reason for this is that proteins differ in their digestibility—though not very much. More important is the difference in their content of the essential amino-acids. In particular, the egg proteins that have to be laid down by the bird contain higher proportions of the amino-acids lysine, cystine and methionine than do the average vegetable proteins. In consequence, a greater weight of vegetable protein has to be digested, or "dismantled", to provide the component parts for rebuilding protein of the type needed by a developing embryo in the egg.

The amount of each amino-acid in the main foods is now well established, but laying experiments are so slow and expensive that it is not yet possible to state the exact requirement for each by the hen. But it is known that when white fishmeal, a protein source of high quality for satisfying the amino-acid needs of growing birds, is used as the sole supplement in a laying ration, the total level of protein can be dropped below the level needed when groundnut meal, an inferior source of the essential amino-acids, is used as the sole supplement[5,6].

In general, the low quality in a particular protein can be overcome by feeding it at a higher level. In attempting to take account of this, the actual crude protein contributed to a ration can be given an approximate adjustment to the equivalent level of average quality protein by multiplication with one of the following factors:

White fish, herring and whale meat meals; dried milk	× 1·2
Cereals; soyabean and meat meals; yeast .	× 1·0 (that is, no correction)
Pea, bean, grass, groundnut and meat-and-bone meals; condensed fish and whale solubles	× 0·8

The protein standard, discussed above, is intended to apply to these figures of "Quality adjusted protein" (Q.A.P.).

Vitamins, minerals and additives

In addition to their protein content, it has been generally considered that animal products, and fish meals in particular, contribute something extra that is needed by laying hens kept intensively over long periods[4,6,7]. Vitamin B_{12} is one factor that occurs only in animal products (or special fermentation

supplements), but this does not seem to constitute the whole story, and it is usually considered wise to include 2½–5 per cent of white fish or herring meal in the diet. It is not possible yet to be more precise than this.

Of the other vitamins required, only A and D are likely to need special provision. For rations that may be stored for a week or more before feeding a stabilized preparation is advisable. (The special needs and problems of a breeder's ration are not being considered here.)

If the ration is balanced to contain 2·4 per cent of calcium and 1 per cent of phosphorus, or proportionally more for high-energy diets, as in the case of protein, there is no need to give additional limestone grit. Similarly, 0·35 per cent of salt, fortified with 1 per cent manganese sulphate is a safe level of supplement.

Of the other additives sometimes suggested, the amino-acid methionine help to raise the value of the vegetable proteins, but its price makes it uneconomic for this purpose at present; stabilized tallow increases the energy content of rations, but costing of complete laying rations with and without added fat, and the protein to balance it, prohibits its profitable use. High-level feeding of antibiotics is also recommended by their manufacturers, but there have been insufficient experiments under British conditions to provide a firm basis for such a procedure as yet.

Choice and use of rations

Some formulae are shown in Table 2 as illustrations of contrasting mixtures. It is the intention of this article to recommend flexibility in the choice of a formula according to current prices, so the table is only presented as a guide. In drawing up a ration when the analysis of ingredients has to be taken from published tables it is wise to assume a figure of 9 per cent for the crude protein content of the cereals. Many samples are below the usually-quoted 10 per cent. Table 2 also shows the importance of making allowance in formulating a mash for even a low level of grain feeding. It is the total of protein per day that is important, and the intake of mash is proportionally reduced when a grain feed is given.

When high-energy laying diets were first tested it was thought that birds might become seriously over-fat. In fact this has not seemed a serious problem provided the protein percentage was properly adjusted. It may, however, prove to be a source of trouble for strains that have an inherent tendency to over-fatness under intensive conditions.

A poultryman buying compounded feed must expect to pay more for a high-energy diet. But if he is comparing costs with another ration of which his birds eat 5 oz a day, and he expects them now to eat only 4 oz a day, then as long as the price of the new diet *per ton* is not more than 25 per cent above that of the old one, its use should be an economy. Unfortunately, a manufacturer's claim to be selling a high-energy diet cannot be supported by a simple figure of chemical analysis, though it may eventually prove possible to adopt a formula derived from three or four separate analyses which gives a reasonably good estimate[2]. It has proved a reliable guide to take a flock's *ad lib.* consumption, at any particular level of egg production, as an inverse measure of the diet's energy value.

Table 2

Illustration of Contrasting Rations

LOW-ENERGY			HIGH-ENERGY		
Component	All-mash feeding	To be fed with 1·8 oz grain	Component	All-mash feeding	To be fed with 1·5 oz grain
	per cent	per cent		per cent	per cent
Barley	42·5	14	Maize	45	42·5
Oats	20	30	Wheat	35	28
Pollards	25	38	Herring meal	3	4·5
White fishmeal	2·5	3·5	Whale meat meal	3	4·5
Groundnut meal	1	1·5	Soyabean meal	5	7·5
Lucerne meal	5	7·5	Grassmeal	4	6
Ground limestone	3	4	Ground limestone	3·3	5
Bonemeal	0·5	0·8	Bonemeal	1	1·5
Salt (+manganese)	0·3	0·4	Salt (+manganese)	0·4	0·6
Cod liver oil	0·2	0·3	Cod liver oil	0·3	0·5
Total	100	100	Total	100	100
Per cent crude protein in mash	12·6	14·2		15·3	18·3
Metabolizable Therms per 100 lb mash	107	98		137	126
Weight of mash (or mash and grain) contributing 0·36 M. Therm	5·4 oz	3·6 oz (+1·8 oz barley)		4·2 oz	2·7 oz (+1·5 oz maize)
Protein per M. Therm of ration (mash and grain)					
a. by analysis	0·117	0·116		0·112	0·112
b. after quality adjustment (Q.A.P.)	0·118	0·117		0·118	0·118

Lastly, one of the biggest factors determining the feed costs for a given number of birds is their body-weight. Undoubtedly Leghorns with their low feed consumption give the highest efficiency in terms of "lb of feed per dozen eggs". But the extra ounce or so of feed needed each day by a heavier bird may be offset by a higher final carcass value. For a light strain of Leghorn, a higher protein standard of 0·125 lb quality adjusted protein per metabolized Therm would be safer than the general recommendation.

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Game Birds on the Farm—1

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Game birds are a valuable by-product of farming and in this article, the first of two, the writer discusses suitable nesting cover and summer and winter feeding.

The average farmer is well aware of the species of wildlife which share with him the produce of his farm or favour the environment he has created for them. He may have suffered from the depredations of rabbits and rats, pigeons and rooks; on the other hand, he may have had many tasty meals from the occasional pheasant or brace of partridges—or even a trout from his stream. Whatever his attitude, no farmer, forester or indeed any working countryman can completely ignore the impact of wildlife on his attempts at the full utilization of land for his own benefit. We hear a lot nowadays about the balance of nature, and we can always say that something has upset it if we get a plague of field mice or wireworm, or if badgers raid our poultry-houses. But the main theme of this article is based on the presumption that a naturally-controlled balance of wildlife populations no longer exists on British farmland. There is still a fluctuating balance on the Arctic tundra and in a few tropical forests, but from the moment man discovered he could

get more food by cultivating certain plants and animals and destroying others, nature was no longer able to maintain this delicate balance between species.

Having interfered so much in this part of the world with natural balance, it seems logical that we should now seriously attempt to *control* nature—in other words, adjust wildlife populations as we consider best in various circumstances. This does not by any means imply more destruction of wildlife (we have certainly done too much of that already), but a carefully planned policy of land utilization, taking into account the fundamental principles of nature conservation as well as controlling the numbers of such species as we consider harmful or beneficial to our purely selfish economy. Briefly, this is a philosophy of "live and let live", but in an intelligently selective manner.

Although we have not yet enough knowledge to classify all species of wildlife into good, bad, and neutral, we can define to some extent the extremes of good and bad and, for the time being, leave the rest to their own devices.

Two obvious groups on which we can take action without further knowledge are, in the good class, game birds and, in the bad, such recognized farm pests as rabbits, rats, wood-pigeons and the crow family. A good deal has already been done by individuals to preserve game, and by the Government to destroy pests, but I suggest there is wide scope for the average owner-farmer to do more about both, as a combined operation and with clear benefit to himself. The farmer who makes a determined effort to keep down his pests can, at the same time, do a lot to encourage an increase in game.

Waste products supply food

It seems logical to regard game as a supplementary crop or "by-product" of farming and forestry and, without interfering with the primary use of the land, to do whatever is possible to encourage the production of a reasonable stock of game. Studies of the natural food and habits of partridges show that these birds live almost entirely on waste products of farming—weed seeds, shed grain on the stubbles and the leaves of weeds, grasses, and clovers. In the early stages, the young chicks eat mainly insects and caterpillars. The clover and grass eaten in the winter are the only items which could possibly affect farm cropping, but the quantities taken, even with a heavy stock of partridges, are quite insignificant. If any bird can be said to be the friend of the farmer from the feeding angle, it is certainly the partridge. Pheasants have a similar but rather more mixed diet, dependent on what is available in fields and woodlands, so in reasonable numbers they rarely damage a normal farm crop. Excessive concentrations of artificially-reared pheasants could be a nuisance, but since damage is most likely to occur in spring, when the density of stock is at its lowest, there are seldom any noticeable troubles. One flock of wood-pigeons can do more damage to farm crops in a single afternoon than a heavy stock of game the whole year round.

Most owner-farmers who have good crops of game prefer to keep the shooting for themselves and their friends, but good shooting is always in demand, and a flat rent of anything from two to six shillings an acre is normal. It often pays better to take in "paying guns" at a fixed sum for the season, the owner retaining control of the shoot and still getting his personal

sport. Obviously the price which can be asked for shooting depends largely on the density of game and its management—the number of targets which can be offered to the guns—so its value is governed by the measures taken to encourage the survival of a shootable crop. Indeed, it should be the first axiom of game conservation that the shootable crop is the annual surplus created by our own efforts to protect and conserve game. Left to nature there is hardly ever any permanent surplus above the requirements of the population to maintain itself in that particular environment.

Nesting cover

On a normal mixed farm in England, with a good proportion of arable, food is seldom the limiting factor for partridges and pheasants. There are certainly large areas of well-farmed land capable of producing ten or twenty times the present game crop. It is not always easy to see exactly why some land is better than other for natural game production, but there are at least five basic requirements for the maintenance of high level stocks of both partridges and pheasants:

1. Safe and suitable nesting cover, well distributed, where the birds have a good chance of hatching without destruction or disturbance.
2. Summer cover—crops in which the broods can survive and feed after hatching.
3. Winter cover and food to hold the stock until the nesting season.
4. Some degree of protection from natural enemies, human disturbance and farm operations.
5. Careful conservation of an adequate breeding stock from year to year—avoiding overshooting.

The pattern of interspersing nesting cover in relation to the crops on a farm, rather than the quantity of cover, is one of the most important factors influencing the "carrying capacity" for game. Untidy farming, with overgrown hedgerows and masses of scrub, is not necessarily favourable. In fact, too much of this sort of cover is more likely to provide a sanctuary for rabbits and vermin to the detriment of the game. Some of the best natural game range in this country at the present time is in north Norfolk and Lincolnshire, on highly-farmed land with neat hedgebanks and occasional shelter-belts, but very little waste land. The average field size of between 20 and 30 acres seems to be important, since it controls the interspersion of nesting cover, especially for partridges. These birds do not like too close a pattern of hedges with small fields, and in any case they cannot make full use of large fields. In first-class game country there is often an average density of a nesting pair of partridges to about 5 acres, which means that on the average there must be suitable nesting cover adjacent to each unit of 5 acres—the condition automatically created by hedged fields of 20–30 acres. The lack of hedges and substitution of wire fences in the more open type of country naturally creates a nesting cover problem, but this can be partly solved by establishing small nesting sanctuaries along some of the wire fences, by the side of field tracks, pit-holes, steep banks or even at the base of electricity pylons, thus creating a better interspersion of cover. These sanctuaries can be made quite simply by roughly fencing off only a few square yards from grazing, so allowing a small patch of natural vegetation to grow undisturbed and provide adequate nesting cover for a partridge or pheasant.

Crop pattern

Losses during the nesting period and soon after hatching from causes other than bad weather can easily account for more than half the potential crop of partridges and pheasants. After hatching, the survival of the young birds is greatly influenced by the nature of the crops in the immediate vicinity of the nest. For example, a brood hatched in a fence between two sugar beet fields stands much less chance than one situated between two corn crops, because, whereas sugar beet fields in June are usually little better than bare ground, corn provides both food and cover from winged predators. Young birds forced into standing grass, by being hatched between two leys, may be cut to pieces a few days after they leave the nest. The obvious need, as with cover, is interspersion, or a mixed cropping plan, so that as many broods as possible have the choice of two or three different crops near their hatching point. A three- or four-course rotation, planned to maintain a chessboard pattern of different crops, can be excellent farming and, quite incidentally, produce the ideal environment for game. Block farming, where the roots, corn and grass are systematically grouped into adjoining blocks of several hundred acres, can never help the survival of game.

The right field pattern of crops in summer naturally gives a good interspersion in winter of plough, roots and kale, and grasses. A planned interspersion of new leys throughout the farm is probably one of the most successful ways of holding game over the winter, especially leys adjoining kale. Kale grown for seed is particularly helpful to game where woodland cover is scanty, since it provides good pheasant-holding cover all the year round.

In the October issue, Mr. Middleton will be writing about the protection required by game birds from natural enemies and farm disturbances and on the conservation measures necessary to maintain adequate breeding stock.

Commercial Anemone Growing

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In the last few years, disease has caused set-backs in the anemone industry, but growers and research workers are striving to combat the losses. Attention is also being given to improving bloom quality, which is such a telling factor in marketing the crop profitably.

ANEMONES have long been regarded as one of the most important flower crops of the South-West, where they are grown in open fields without protection and, except during periods of extreme cold, bloom throughout autumn, winter, and early spring. Several hundred acres in Cornwall, Devon, and the Cheddar district of Somerset are devoted to the crop, and it is also grown to a limited extent in other parts of the country under cloches or in cold houses. Most of the anemones seen on the markets, however, come from the West Country. The crop is much favoured by small growers because it does not lend itself readily to mechanization and requires a good deal of hand work, which is often provided by family labour. A proportion of the crop is grown by part-time workers, who cultivate small areas and manage the cultivations at weekends and in the evenings in summer. The picking and bunching are done by their wives. It is a popular market flower with shoppers, since fresh cut blooms will last up to three weeks in water.

For some time after the war, anemones were a very profitable crop. Apart from bad weather which prevented flowering, and occasional attacks of *Botrytis*, the crop was an easy one to grow and sell. During the past three or four years, however, the position has changed. Two serious troubles, Anemone Mosaic and Downy Mildew (*Peronospora ficariae*) have become common on plantations in the South-West; they have interfered considerably with production and greatly reduced the prospects of a reasonable return. In some cases there has been complete failure—a serious matter with a crop that is so expensive to produce. Apart from trying to combat these particular troubles, progressive growers are constantly striving to improve the quality of the blooms. Generous manuring, good cultural methods, adequate protection from wind, pests and diseases and the use of disease-free corms of first-class strains, all have a marked effect on quality, which is a more important factor with anemones than with most flowers, as the price range shows. For example, on a single day last season in one market prices varied from 6*d*. to 3*s*. a bunch.

Varieties and cultivation

The single-flowered de Caen type of anemone is the most popular, but the double-flowered St. Brigid is grown to a small extent. The St. Brigids do not bloom so profusely in winter and are less popular at that time with buyers.

They are really best in late spring and early summer, as they travel better in warm weather; the de Caen type is not then so satisfactory. Bunches of mixed colours are required by the market, but named varieties are sometimes grown in small quantities to keep a well-balanced bunch. Single-flowered varieties include His Excellency (scarlet), Mr. Fokker (purple), Sylphide (magenta), The Bride (pure white). Double-flowered include Lord Lieutenant (blue), The Admiral (violet-mauve), and The Governor (scarlet).

Anemones suffer more than most crops from the effect of wind, and so it is necessary to provide adequate protection. All kinds of windbreaks are used; the lath hurdle is probably the most effective, but wicker hurdles and coir and small-mesh wire netting are satisfactory. Good protection can be obtained by interplanting three rows of late broccoli or kale between every ten rows of anemones. The remains of some summer crops, for example, peas, runner beans, and sweet corn, make effective windbreaks, and natural windbreaks such as hedges or shelter belts can be used. In areas near the sea, where many anemones are grown, escallonias provide a quick-growing, winter-hardy hedge, and they are easily propagated from hard or soft wood cuttings.

Anemones need a fresh site every year. Trials at Rosewarne Experimental Station suggest that infection with Downy Mildew increases proportionately as the land continues to be used for anemones. On large farms this need for "new" land presents no difficulty, but to the small grower it is often a problem. It does not seem to be sufficient merely to shift the site to another part of a field; a move to a completely different one seems essential. It may be that the difficulty will be overcome by hiring fields from farmers for short periods, as is done by some bulb growers. Freshly broken-up leys in a high state of fertility are very suitable, or anemones may follow such crops as broad beans or spring cabbage, which leave the land relatively free of weeds. Generally, the best quality flowers are produced on the heavier types of soil, but good drainage is essential. Raised beds help surface drainage and raise the soil temperature in cold weather. A pH of 6·5 is satisfactory, but more alkaline soils may be used. If lime is necessary, it should be applied in the winter previous to planting.

Farmyard manure at rates varying from 20 to 30 tons per acre is ploughed in during the winter. A fortnight before planting, the land should be dressed with 5 cwt hoof-and-horn meal, 5 cwt bonemeal, and 5 cwt sulphate of potash. Mixed grades hoof-and-horn and bonemeal up to $\frac{1}{8}$-inch grist, ensure a steady supply of nutrients over a long period.

Seed or corms

Anemones may be grown from seed or corms, but most growers use corms. The small dried roots known in the trade as corms are, strictly speaking, tubers. Crops from seed are less susceptible to disease, more resistant to frost damage, show more vigour, and have a longer flowering life, but unless the ground is very clean, seed may prove very costly. In America seed is used almost exclusively, but in this country few growers attempt this kind of production. Germination is slow and rather chancy, and in a dry spring, establishment can be difficult if irrigation is not available. The woolly seed masses should be disintegrated by rubbing in sand, and the period before

the seedlings appear can be reduced by "chitting" the seed in moist sand under warm conditions for two to three weeks before it is sown. Alternatively, pre-emergence weedkillers such as P.C.P. can be used to reduce weed growth during this difficult germinating period. The seed is best sown in March in drills 12 inches apart, and dropped in clumps 7–8 inches apart in the drills. About 8 lb of seed is required per acre, but by "chitting" this can be reduced to 3 lb. In dry periods, irrigation is beneficial; intermittent shade (such as that provided by lath hurdles) and mulching with fine peat are advantageous.

Most west country growers use 2–3 centimetre corms, and plant from May to August, though June is the favourite planting month. In later districts such as Cheddar, July and August plantings with 3–4 centimetre corms are preferred. It is customary to plant in well-consolidated soil and to cover the corms to a depth of 3 inches. Various spacings are adopted, perhaps the most usual being to plant in rows 12 inches apart, with two corms per station at 8-inch intervals in the rows, four rows to a bed, and with a picking path in between. After making allowances for headlands, about 100,000 corms will be required per acre. An alternative method is to plant in rows 24 inches apart, with two corms per station at 8-inch intervals; this system needs 65,000 corms per acre. It appears that better results follow where two corms are used per station than where the corms are planted individually.

Weeds: top dressings

Apart from the use of pre-emergence weed-killers, the control of weeds must be by hoeing or by hand. It is important not to disturb the plants, and for this reason weeds in the rows should be cut off and not pulled out. It is best to hoe before weeds appear, but in any case hoeing should be discontinued in September, otherwise the anemones may be seriously damaged.

Where the land has been generously treated with organic manures and base dressings of fertilizers, little top dressing will be necessary. Growers generally prefer to use organic top dressings if these are considered desirable, and applications of 1 cwt per acre of dried blood are common. Too much nitrogen should be avoided, especially before the severe weather sets in, otherwise growth will be too soft.

Protected crops

In most districts other than the South-West, some protection is necessary if winter flowers are required, and in these areas anemones are grown quite successfully in cold houses, frames, or under cloches. Under the humid conditions of the South-West, however, results under glass are less satisfactory. In cold areas, many more and better blooms are produced from cloches and other types of low coverage. As with outdoor cultivation, the de Caen varieties are most suitable for cloche and cold house work. With tent cloches, it is usual to plant two rows of corms 8 inches apart down the centre of the cloche row, with the corms at 4-inch intervals. With the larger barn-type cloche, four rows per cloche can be planted; 3–4 centimetre corms are used, and they are planted 3 inches deep. With this spacing, 1,800 corms are required per 100-foot run of tent cloche, and 3,600 for the barn type.

For winter flowers, the corms should be planted by the third week in June, the cloches usually being put on in October. For spring flowers, planting in July is early enough, the cloches coming into use in January. When the stems become too tall, usually about the end of March, the cloches can be removed.

The labour requirement for anemones under cloches is very high, but it can be reduced if the cloches are of the type which facilitate easy removal of the top glass, and also if pre-emergence sprays are used.

Ventilation may be given on warm days, although some growers seem to be able to dispense with it altogether. In the more humid areas it is probably better to cover during bad weather only.

The methods adopted for growing in cold structures and movable houses are similar to those adopted for outside except that early planting is not advisable. The middle to the end of July is the best time, using 3–4 centimetre corms. Some small growers plant in deep boxes which are kept outside until October, and are then taken into the houses and stood on the borders or benches.

Preparing for the market

Where possible, picking or cutting should be done from the pathways to preserve the physical condition of the soil. Some growers prefer to pick, saying that many young buds at the base can be injured by the cutting instrument. Others say that cutting is best, as loosening of the plants may occur through picking. If the flowers are cut, the knife should always cut downwards. Care should be taken to pick in the right stage, that is, when the buds are well coloured and the petals have reached their full length, but before the flowers are open. In warm weather, cut the blooms hard, but when it is cold the buds should show more colour.

After gathering, the blooms should, if possible, be graded into three qualities: specials, 9-inch stems and over, mediums, 4 to 9-inch stems, and shorts, less than 4-inch stems. Strict grading is essential, and the same standard should be aimed at throughout the season, though owing to weather conditions this cannot always be achieved. The graded blooms are usuálly arranged in flat-sided bunches (with twelve flowers in each) with four tiers of three blooms. However, some salesmen prefer a round bunch, which is useful for short-stemmed flowers. Bunches of mixed colours sell best, and an attractive combination can be made with three scarlet, three wine-red, three blue-mauve, and three mixed, including one white bloom. The bunches should be secured with rubber bands and then stood in deep water for periods varying with the season. In warm weather this will amount to a few hours only, but as the days get colder the flowers can be held for longer periods. The buds develop during this period, and the stems lengthen considerably.

Various kinds of boxes, wood or cardboard, are used for anemones. It is important to drain the bunches before packing, and they must not be packed when the blooms are wet; in wet weather, they can be dried off in a warm shed. Line the boxes with white sulphite or a semi-greaseproof paper, and allow some head room because the flowers tend to grow in transit. The use of cross sticks to hold the bunches in position is essential. End to end pack-

ing is preferable when using cardboard boxes, which are best tied together in pairs; wood boxes should travel singly or in pairs.

Pests and diseases

Downy Mildew and Anemone Mosaic are undoubtedly the biggest problems of the anemone grower. A new treatment for mildew tried out at Ellbridge Horticultural Station recently is promising well on heavily contaminated soils, but further work is necessary before any general recommendations can be made. A 4 per cent solution, that is, one gallon of formaldehyde to 24 gallons of water, is applied to the soil at two-thirds of a gallon per square yard, three weeks before planting and the treated area rotavated as deeply as possible immediately afterwards. The cost of the material used is about £30 an acre. While the labour of putting on this quantity of water may seem excessive, it can be considerably reduced by applying the solution through overhead irrigation lines.

Mosaic disease, being a virus, is not directly controllable by spraying, and it would seem that growing from seed instead of from corms may provide the best answer to this problem. *Botrytis* causes losses in some seasons, but can often be reduced by wide planting and adequate wind protection.

In the South-West, symphilids may be troublesome, but they can be partly counteracted by applying a 3½ per cent BHC dust at 1½ cwt per acre. Aphids can be controlled by spraying with either HETP or malathion.

What of the future?

Is anemone-growing ever going to be as good as it once was? This is a question which is being asked by many growers. Just at present the industry is facing three serious problems: virus diseases, Downy Mildew, and competition from the Continent. We hope that eventually the pathologists will find an answer to the troubles from diseases, and the third difficulty will have to be overcome by the production of more high-quality blooms. In the South-West this may be achieved by the provision of some kind of temporary cover for use during spells of bad weather. In the meantime, the acreage is keeping up reasonably well and growers seem quietly confident that anemone-growing is still worth while.

Linnaeus

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Linnaeus, whose great basic work of classifying the genera and species of plants, animals and insects has done so much to promote the study of botany and zoology, was born 250 years ago.

THE great Swedish naturalist Carl Linné, Carl von Linné as he later became, was born on 13th May, 1707, at Råshult, in the province of Småland in southern Sweden. Today he is most often known to the world by the latinized form of his name, Linnaeus. The 250th anniversary of his birth has recently been celebrated at Uppsala, where he lived and taught for nearly fifty years, and by the Linnean Society of London. He was the son of a perpetual curate, afterwards rector, of the Lutheran Church. There is no doubt that it was to his father that he owed much of his love of plants and gardens and natural history in general. His early training was directed to his entering the church, but it soon became apparent that he was not fitted for this vocation. He determined to become a medical man and a botanist. In those days medicine and botany were more closely related than they are now, though it has to be confessed that Linnaeus greatly favoured the latter. He went to the University of Lund, but was there for only a short time. In September 1728 he became a student at Uppsala and was at, or associated with, the university there until his death, apart from intervals for travel and a short sojourn in Stockholm.

Much of the teaching at this time appears to have been of a very low standard, but Linnaeus attended lectures in natural history and in medicine. Various friends and benefactors assisted him financially and in other ways, and he earned money by giving demonstrations and private instruction. He made an important expedition to Lapland in 1732 to study the botany, zoology, and mineralogy of an area about which little was then known.

Linnaeus left Sweden for Holland in 1735 and remained abroad for three years; his main object was to take his doctor's degree (the idea having been established in Sweden that a doctorate was valid only when it had been taken in a foreign land), and, in due course, he was promoted to the position of Doctor of Medicine at Harderwijk. In Holland he met Georg Clifford, a wealthy director of the Dutch East India Company, who had a large botanical garden at Hartecamp, between Leiden and Haarlem. Clifford employed Linnaeus to work through and name his rich collections of plants. The *Hortus Cliffortianus*, published in 1737, is a descriptive account of the plants in Clifford's garden, and the herbarium of dried specimens prepared from them is now at the British Museum, Natural History, South Kensington. During this period Linnaeus visited England, whence he returned to Holland and, in 1738, settled finally in Sweden. He was appointed Professor of Medicine and Botany at the University of Uppsala in 1741, and this city became the centre of his life and activities until his death on 10th January, 1778.

His work on classification

There is no doubt of the great influence which Linnaeus exercised on the progress of botany and, to a less degree, of zoology. He had a deep love of plants and especially of growing and studying them both in his gardens and in the wild. His outlook was surprisingly wide and often philosophical. Primarily, he was what we would now call a taxonomist—that is, one who is engaged in classifying, describing, and naming organisms, and in studying the underlying principles of classification. To appreciate the contribution of Linnaeus to this branch of biology, and to botany in particular, it is necessary to recall the need for classification and names.

Only a rough estimate can be made of the number of distinct kinds, or species, of animals and plants populating the earth today, and no guess would be worth while of the number of species of past geological ages now extinct. There are no recent monographs of many groups, and even now some parts of the world have not been explored by trained botanists and zoologists, and there is considerable diversity of opinion as to specific limits. Probably there are well over two million species of organisms now existing on a reasonable usage of the concept of species, the insects being the largest group. The seed-bearing plants can be estimated at a quarter of a million. These are large numbers, and for both scientific and economic reasons it is essential to classify them and to give them names. Grouping them into classes, describing the class differences, and providing a nomenclature are part of the work of the systematist. Latin names, with a world-wide recognition, have an obvious advantage over vernacular names which vary according to language and local usage. It is the rule now that every species is placed in a genus and has a name composed of the generic name followed by a specific epithet. This "binomial nomenclature", as it is called, was introduced by Linnaeus for plants in the *Species Plantarum*, published in 1753. Though this method of naming was only one of the contributions to science made by Linnaeus, it has persisted practically unchanged in both botany and zoology for over two hundred years—a clear proof of its value.

The so-called "Sexual System" by which Linnaeus classified the plants known to him into twenty-four classes, mainly on the basis of the number of stamens and capels, apart from the heterogeneous class of "Cryptogamia", was used for many years until it was superseded by systems based on the correlation of many more characters. Linnaeus himself valued his "System" more than his nomenclature. It has to be remembered that two centuries ago relatively few species of plants were known. For example, Linnaeus named only five species of *Rhododendron* in 1753, whereas now over five hundred are known—though this may be a rather extreme example of the progress of botanical discovery in the last two hundred years. The Linnean system could, however, accommodate most, if not all, of the new plants described since his time, with relatively little change of its structure and few, if any, additions to its main classes. It brought logical order in place of previous vague arrangements. Linnaeus himself did not regard it as final and had, indeed, made suggestions for classification using a larger number of characters.

It is important to realize the change of outlook resulting from acceptance

of the theory of evolution following the appearance of Darwin's *Origin of Species* in 1859. Linnaeus and his contemporaries were limited by the dogma of the fixity of species—that species had been created once and for all "at the beginning". Some remarks scattered through the publications of Linnaeus suggest that his belief in the fixity of species had its limits; but, be this as it may, it was impossible for an evolutionary outlook to pervade his work as it does all branches of biology at the present day. There is an interesting fact in the history of botanical classification that would repay detailed investigation. Linnaeus's Sexual System is often referred to as an artificial one and, it is claimed, it has been replaced by "natural" systems. A "natural" system is based on taking into account as many characters as possible and the results can largely be explained by the theory of evolution. However, especially for the seed-bearing plants, such "natural systems" were published before 1859 and provided very strong support for the theory of evolution.

A man of many parts

Linnaeus was a great teacher of botany and many of his students became renowned in that field. Not only did he give lectures and demonstrations in his gardens, but he conducted excursions around Uppsala through woods and meadows. Of some of them he has left excellent accounts. In addition, he assisted many students with their "dissertations". It is impossible precisely to estimate the influence of a great teacher, but this side of Linnaeus's activities should not be forgotten.

The main contribution of Linnaeus to botany was in taxonomy or systematics; however, in his various books he discusses clearly, and often from his own observations, many other subjects. A few of these may be mentioned: pollination and the results of fertilization, hybridization, the dispersal of fruits and seeds, the day and night position of leaves ("sleep" of plants), the opening and closing of flowers at different hours, the development of vegetation at different times of the year, anomalous growths, protection against enemies and unfavourable weather, the formation of buds, different kinds of plant communities, and the relations of plants and animals.

He laid down principles of plant geography and introduced the theory of metamorphosis, or the theory that organs of dissimilar function may belong to one structural class. He corrected many wrong statements of earlier writers and refuted various legends and superstitions that had wide currency. As would be expected from the absence of modern microscopy, Linnaeus's treatment of the vast class of "Cryptogamia" was less detailed and less satisfactory than his treatment of the seed-bearing plants; he had little to say regarding plant anatomy and many branches of physiology. These subjects could be properly studied only when suitable apparatus and techniques had been developed.

Linnaeus's activities in zoology were almost entirely restricted to systematics. He introduced a definite terminology and nomenclature. Amongst other improvements, he removed whales from the fishes to a mammalian class, used different structures of the teeth in classifying mammals, and provided new arrangements for reptiles, fishes, and molluscs. He contributed also to the knowledge of geology and mineralogy and to medicine.

The name of Linnaeus must be held in esteem by all who work with plants and know enough of the history and principles of botany. Classification is necessary in every science—in botany it has to be primary to all research if this is to add to the general body of knowledge. Accurate determination, summarized in a name valid by rules accepted internationally by botanists, is essential for recording any facts in scientific publications. It is also essential in many branches of horticulture, forestry, and agriculture. The binomial system of naming plants and animals at the species level is still without a rival, and its continued use remains, after two hundred years, a tribute to the genius of Carolus Linnaeus.

Safety: P.T.O.'s and Ladders

P.T.O.'S AND P.T.O. SHAFTS

New regulations made on 1st August, 1957, are designed to safeguard farm workers against accidents with power take-offs and power take-off shafts. P.T.O.'s of tractors or similar vehicles must be covered by a shield unless sealed off by a fixed cover. Similarly, the p.t.o. shaft must be protected along its whole length from the tractor to the first bearing in the machine.

Responsibility for compliance is shared between employer and worker, and the requirements come into force:

1. as they affect tractors—
   (a) on 1st August, 1958, for new tractors with a power take-off, or for tractors which, although not new, were designed to take power take-off shield;
   (b) on 1st August, 1959, for tractors already in use on 1st August, 1958, with a power take-off, but which were not designed to take power take-off shield.
2. as they affect machines which have a power take-off shaft—
   (a) on 1st February, 1959, for new machines;
   (b) on 1st August, 1959, for machines already in use on 1st February, 1959.

LADDERS

Further regulations also made on 1st August concern ladders and prohibit the use by an agricultural worker in the course of his employment, of portable ladders that do not conform to these regulations. After 1st November, 1957, it will be the duty of the employer only to let a worker use a ladder which is soundly constructed and properly maintained; in addition, workers must ensure that any ladder they use complies with certain prescribed conditions and that it is only used for purposes or in a manner for which it is suitable. Workers are also obliged to report certain types of obvious defects to their employer, but this obligation does not relieve an employer of the responsibility placed on him under the Regulations.

The above brief notes do not cover points of detail such as the required strength of the material used for the p.t.o. shield, etc., but copies of the Statutory Instruments (P.T.O.—1957, No 1386, and Ladders—1957, No. 1385) can be obtained from H.M. Stationery Office, Kingsway, London, W.C.2, or through any bookseller, price 3*d*. (5*d*. by post).

Ways with Stock at Thurgarton

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**"Some for renown on scraps of learning dote,
And think they grow immortal as they quote"
—but the writer set out to get first-hand experience, and these are his very personal observations upon some practical techniques with livestock.**

Hay quality

Hay still features prominently in the daily diet of cattle at Thurgarton. Grass is cut young and then made quickly by frequent turning and tedding preparatory to baling within, say, forty-eight hours at 35 per cent moisture content. Phosphating generously and grazing late, even into May, are our two main factors in producing a quality crop of hay with plenty of clover in it and a protein content of 12–15 per cent. With hay of this quality, we find there is no need to restrict the amount of such hay fed to our Ayrshires.

Restricted concentrates

On the other hand, to feed a lot of concentrates to a cow ensures a heavy cut-down on hay intake by the cow herself. We find that, having very good hay, it is of paramount importance to restrict the amount of concentrates provided to a predetermined maximum allowance. By way of illustration, a 1,200 gallon cow was eating 46 lb of hay and 5 lb of concentrates per day. The concentrates allowance was increased after a time to 10 lb per day. The cow ate 33 lb of hay; in fact, she reduced her hay intake by 13 lb to accommodate 5 lb of concentrates and so made a bad bargain nutritionally. For many years in one herd, averaging 950–993 gallons N.M.R., the ceiling of concentrates provided was 12 lb (or exceptionally 14 lb) per day. The average cow ate 26 lb and 18 lb of hay when in milk and dry respectively.

Role of succulents

In the dairy herds, succulents are fed at a rate adjusted to secure that the manure is of smooth consistency. If the manure is too thin, the amount of succulents fed is reduced; if too thick and solid, the amount of succulents is increased.

Avoid digestive explosions

To my way of thinking, the modern way of feeding succulents, fibrous bulky feeds and concentrates in separate feeds is a design for danger. I am reminded of a cartridge manufacturer who takes a tube (the cow's alimentary tract) and rams in successively powder (succulents), shot (fibrous feeds) and

then caps (with concentrates)—with the same kind of potentially explosive result! A lot of our young cattle are fed along old-fashioned lines—chop, chaff, pressed wet pulp and concentrates all mixed together. This is easy and simple to feed, each beast gets its share of everything, digestions are never upset, the cattle lie down contentedly between feeds and they develop great underlines.

Maintenance and production

In view of the fact that our cows lose about 3 cwt during the first 4½ months of lactation and put it on at the end of their lactation and during the dry period, we patently do not feed for maintenance and production. By theoretical standards, our cows are fed less than they require early in lactation, and more in late lactation. We allow them to mobilize their reserves in order to avoid straining their digestive apparatus at the peak of production. However, appetite and productivity are closely correlated in our best strains.

Grass utilization

Our experiences with grass in our low rainfall area and on our heavy clay are that rotational grazing is advantageous and that rationed grazing is beneficial, in so far as it ensures that grass is not wasted by trampling and soiling. We are impressed very much indeed by our experience with an electric back fence following down behind the cows to ensure that the new growth is not re-grazed and future productivity correspondingly impaired.

Our chief complaint is against lush, limp grass which cows are so often expected to milk on and which in practice frequently scours them, thins both them and their milk and predisposes the animals to ill-health. Our experience suggests that grass should be at least 8 inches high before the cow is allowed to graze it, particularly in spring.

F.Y.M. on grass

The essential features in the proper use of yard manure on grass if it is not to depress palatability are that it should be applied thinly and in a well-rotted condition. Used in this way, the pastures improve, the clovers develop and the grazing is very readily controlled.

On our worst clay fields the comfort of earthworms is worth considering. They are present in abundance in our well-managed pastures. Their disappearance from a grass field is a prelude to its deterioration, unless urgent corrective measures are taken. Rotten farmyard manure is an especially valuable dressing, and so, too, is a run-over intensively with sheep.

Sheep pastures

Sheep pastures are easily made on the clay. We start with a predominance of perennial ryegrass, S.23, and S.100 white clover. We stock heavily and use cattle as necessary to trim back for the sheep. Set stocking with sheep has fewer snags than might be anticipated by theorists, and certainly it is the quickest technique for pasture development. This spring, for example, on a

9-acre field a set stock of 50 fattening lambs and their dams was maintained, and as fats were draughted out an equal number of new ones were draughted in. As required, young Ayrshire heifers (up to forty at a time) were turned in for grazing to keep the grass eaten back. No technique in the whole gamut of farming techniques ensures July and August grass growth better than heavy set stocking with sheep in April and May.

Young dairy stock are grazed with sheep to the advantage of both. The cattle keep the grazing under control and get the coarser fraction left by the sheep, the more selective grazers, which pick out the more protein-rich, succulent and digestible parts of the sward.

Ewes after weaning

When lambs are sold fat off the ewes, the latter are crowded in a very small acreage of grass. Last year, 110 Kerry Hill ewes enjoyed 1 plus 2 acres grazing from weaning date (in May, June and up to July 15th) until August 30th. They were slimmed. Put on good clean keep in September, they flushed readily for tupping, responding as only sheep off a low plane of nutrition will.

Beef, multiple suckling

Successful results have been obtained by persuading a calf to adopt a newly-calved cow, not its dam, as its nurse. This is achieved by supervising the suckling of the extra calf alongside the cow's own calf for three days. At the end of three days the cow and her two calves, for one of which she has no real affection, are put in a paddock with two cows and four calves. When she attempts to suckle her own calf several others converge. She has poor capacity to count above two, becomes confused, fears kicking her own calves and allows all to suck. Later her own calf realizes that it is sharing the milk with *all* the other calves and joins in whenever it can grab a teat. Subsequently, all calves suck all cows.

Suckled calves

Great advantage has been enjoyed in the suckler herd by adopting calf creep feeding. This is apparent during and after the suckling period. The routine dose of phenothiazine against worms and husk is divided into four parts and put in the creep for four consecutive days at the end of each month during the suckling period. Last summer we had 82 suckling calves running together at pasture—parasitically, a very vulnerable unit.

Beef calves on less milk

This technique involves the feeding of 12 gallons of whole milk per calf over a period of 20 days and the early, hastened development of the ruminating process. Deploying aureomycin, adequate vitamins and minerals, interjecting suitable rest periods for pens and paying attention to good hygiene and disinfection, this technique has safely arrived at the farm stage. Perhaps our emphasis on grass and hay in the diet of young cattle, rather

than a high concentrate allowance, is a deviation from the more usual method and necessitates quality in the grazing and in the hay.

Good winter coats

Cleanliness of the hair and skin in a young beast and freedom from dirt and parasites is very important. Our standardized routine of shearing down the backbone and clipping out the polls of our young and feeding cattle and of washing them periodically with BHC and DDT dips is readily appreciated by the most casual observer. The animals have shiny coats, they do not itch and consequently do not rub and bruise the skin. The absence of ringworm has been remarked upon in the lots so treated.

Finishing young beef at grass

The feeding of grass at a stage when it does not scour the cattle and stocking at a rate that ensures that it does not get beyond them are two of the basic features of our grazing programme. In wet weather or when the grass gets short and slushy, satisfactory results have been observed from chaff feeding. The chaff acts in a way that ensures that grass is held by the animals long enough to enable them to extract the nutrients.

Polling cattle

The advantages of dehorning are now widely recognized, and all our commercial cattle are polled. Probably the most important consequence of polling is the greatly increased value of a given set of buildings and the much greater size of cattle enterprise which it makes possible.

Warm pigs

Pigs enjoy warm sleeping quarters and sows and litters appreciate accommodation that is entirely draught-free. Within a brooder house low kennels are provided for them. These are covered with hessian sheets and with curtains that hang down in front, low enough to touch the floor. The sows turn round so that only their noses protrude and the little pigs gather at the back, literally at the bottom of the bed. In the daytime all are driven as a herd to pasture. They return at night to snug accommodation.

Horticulture in Spain

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Mr. Shewell-Cooper has recorded his impressions of a three-weeks' visit to Spain to study the present pattern of horticulture there. He found that the land colonization scheme for the workers in horticulture has given new heart to the industry.

IT would be necessary to spend at least six months in Spain to see the whole horticultural picture in its true perspective, and so in a visit of just under three weeks I was restricted to a study of only three Provinces—Ciudad Real, Granada, and Malaga.

It was obvious from the start that the major problem confronting the cultivators in this wonderful country is the maintaining of an adequate water supply. The officials speak very definitely of "dry land" and "watered land", and so in describing any farm or region the land is always divided into these two component parts. It is significant that the first spot to which a market gardener takes you when you arrive is his well; in many cases the owner cannot afford to instal mechanical means for pumping up the water and still has to depend on the ancient method whereby a donkey walking round and round the well supplies the required pumping power.

My previous visit to Spain was eight years ago, and the tremendous change for the better which has taken place in the interim has to be seen to be believed. Houses and farms are cleaner, cultivations much improved, and the people are better dressed. Perhaps the feature which has contributed most to the improvement is the Colonization Scheme introduced by the Duke of Primo de Rivera when he was Minister of Agriculture a few years ago, and which is similar to our Land Settlement Schemes. Under his scheme, men are each given six hectares* of land which is promptly irrigated either by an overhead system or by channelling the water between the rows of crops. The workers are housed in new village communities.

Ciudad Real Province

I was impressed by the efficiency of the Director in the Province of Ciudad Real—Ilmo. Sen. Don Paulino Alonzo. He was responsible for three sectors comprising some 8,000 hectares. The land is owned by a public company but has the backing of the State with compulsory powers for buying land; there is, however, a proviso that no farmer may be deprived of all his land. Applicants for holdings are selected by a local committee, and after five years' training, and provided their work proves satisfactory, they are allowed to start paying for the land they are occupying. A twenty-year period is allowed for repayment, but some workers clear their "mortgages" within their first few years of occupation.

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* Hectare = 2·47 acres.

To every thirty colonists there is a specially-trained foreman, who is himself a colonist; a County Horticultural Adviser visits them regularly to give specialist advice.

The wells usually have an output of about 6½ million litres* an hour, and each colonist can obtain water for sixteen hours, three days a week, at a very reasonable price. Electricity is supplied to all holdings.

A visit was also paid to the Agricultural School at Daimiel, where twenty-five students are accepted. (Incidentally, there are seven of these special schools in Spain, run by the Trade Unions.) The students, whose ages range from 18 to 30, receive free education, food and clothing, and all their travelling expenses. The living accommodation in the school is very good, and it is interesting to note that the warden in charge maintains a strict watch over the personal behaviour and hygiene of the students! The daily routine includes lectures and practical work on the fruit and cereal crops grown on land belonging to the school.

There are many Agricultural Co-operative Packing Stations in Spain, and the one I visited at Estepona is said to be a typical example. It caters for all market gardeners in a region of about 1,400 hectares. It is open every day, including Sunday, from 9 a.m. to 1 p.m., and 5 p.m. to 8 p.m. (from 1 to 5 p.m. is siesta time!). In the busy seasons the station stays open until 1 o'clock in the morning. Vegetables and fruit are brought in on the backs of donkeys and mules, which travel for miles over mountain paths with their loads of 400 lb and more.

Every day the "fixed" prices are set and shown on blackboards in the station. After the wholesaler has bought his supplies of fruit or vegetables, he is allowed to tip them on to the concrete floor and set to work with his helpers grading, packing, and dispatching the produce.

Growers on a large or small scale all invest in the Co-operative Packing Station; they pay dues on the produce sold each day, but receive dividends on the profits made during the year. They can borrow money for buying machinery and fertilizers.

Methods of cultivation

In contrast to the efficiency demonstrated by both the Government and Farmers' Union organizations are the primitive methods of cultivation. In the 2,000 miles I travelled I saw only one tractor, but there were hundreds of oxen pulling rather crude ploughs and men harvesting barley by hand; there were pigs chained and tethered by the side of the road and droves of goats eating the weeds on land recently harvested.

Unusual crops to our British eyes were the sugar cane and rice. Sixteen varieties of rice are grown in Spain; planting is carried out in May and harvesting in late September. The cutting is done by hand, and after three or four days' drying the crop goes to the mills. In the Ciudad Real province there have been yields of up to 10,000 kilos per hectare (as compared with only 4,000 in China), and it is claimed that these excellent results are due to maintaining the soil at between pH 4 and 5.

I was interested to make some study of the methods of cultivation of out-

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* Litre = 1·75 pints.

door tomatoes. The principal variety grown is Valencia, which produces a large, rough fruit. Another variety is Murcia, which is rather similar to Ailsa Craig; it yields about 40,000 kilos per hectare, and the grower obtains a price equivalent to $\frac{3}{4}$*d*. a lb—a return with which he is satisfied. It is no wonder that the crops can be produced so cheaply, for labour costs are very low; a worker receives only 30*s*.–35*s*. a week, and if he works overtime he receives only the usual day rate. There is always plenty of casual labour available.

The sizes and types of market garden vary considerably; for instance, some businessmen buy market gardens as a sideline and put them in charge of managers; many growers own small plots of land which they cultivate intensively, using an "all compost" crop rotation that includes lettuces, garlic and onions, roots, and tomatoes. No artificials are used. Then there are the bigger holdings—I was able to visit one of these which consisted of nearly 1,000 hectares; almost half of this land is too mountainous for successful cultivation, but the rest produces heavy crops of citrus fruits, olives, almonds, and cereals. The grading and packing of the fruit are done by hand, quickly and efficiently, different coloured wrapping papers being used for each grade.

On the way to Granada, I passed through districts like Motril, where the earliest crops of vegetables are grown in terraced gardens irrigated by a system of small artificial "rivers". In the Vélez de Benaudalla area orange trees are prolific and children stand at the roadside selling the fruit. There are also plenty of sweet cherry trees, but the predominating crop in the Granada province is the olive.

Spain is a country of tremendous contrasts. There are some fertile plains, but also great ranges of mountains; the population appears to be divided between the well-to-do on the one hand, and on the other a large number of poor people, who find it difficult to get work all the year round. But the people are charming and most hospitable, and I got the impression that they have a great sense of awareness and a desire to advance with the times.

My grateful thanks are due to H.E. The Duke of Primo de Rivera, the Spanish Ambassador to Britain, whose letters of introduction so greatly facilitated my visit; to Ilmo. Sen. Dr. Antonio Lavin, his Agricultural Attaché; to Ilmo. Sen. Don Antonio Diaz Gomez of Malaga; Sen. D. Antonio Ayuso Murillo of Ciudad Real; Sen. D. Miguel Guzman Montoro of Granada; Ilmo. Sen. Don. Paulino Alonzo, the Director of Colonization of Ciudad Real; Excmo. Sen. Don. José Utrera Molina; as well as to Sen. Don Antonio de la Huerta, the Research Horticultural Adviser for Malaga, and the growers who gave me so much of their time and hospitality.

The Merino

ALLAN FRASER

Where there is wool, there is the Merino. Over many centuries it has remained unchallenged as the predominant producer of a dense, soft, fine fleece and yielding a greater weight of wool per head than any other breed of sheep.

THE Merino has at times inspired prose that comes very close to poetry. Thus the American, Randall, in praise of the Saxony Merino fleece: "Though the Saxon sheep is a small one, there is an atoning beauty about its wool that is hard to resist. It flashes with such a gem-like lustre; it is so beautifully fine and even; it has such an exquisite downiness of touch; that all other wools seem base beside it. I have seen it so pliant that a lock of it held upright by the outer end, between the thumb and forefinger, and gently played up and down, would bend and dance like a plume"[1].

As to the origin of the Merino, there is really very little to add to what Dr. Parry wrote in the year 1806: "The only settled facts on this subject—and fortunately they are quite sufficient for all practical purposes, are, that in a period anterior to the Christian era, fine-woolled sheep abounded in Spain; that they were preserved and made themselves heard of in the channels of trade and the domestic arts through all the conquests, reconquests, and other sanguinary convulsions of that kingdom; that they were, or gradually ripened into, an exclusive breed unique in its characteristics and essentially unlike all other breeds in the world"[2].

The quite recent work of Carter[3] and others on the developing wool follicle has shown that the Merino, contrasted with all other sheep breeds, is unique in its capacity for fine wool production, since ". . . the Merino stands out in relief against all other genotypes within the species by virtue of a hair follicle group numerically about four times greater".

Whether the Merino, so distinct from all other sheep breeds in its wool production, arose as a sudden mutation is an interesting subject for speculation.

Whatever the origin of the Merino, there can be no doubt that the breed as we know it, like the name, is Spanish and that this sheep and its wool were once an important source of the wealth and power of Spain. The Spaniards guarded the monopoly of the breed closely, the penalty for its exportation being death, and from the sixteenth to the eighteenth centuries that monopoly seems to have been almost unbroken.

But gradually the monopoly was worn down, partly by smuggling through Portugal, partly by gifts from the Spanish kings to royal relatives and neighbours, and finally by the Napoleonic conquest of Spain in the first years of the nineteenth century. The Merino then spread all over Europe, including Britain. France developed its own derivative called the Rambouillet, which may have owed something to an English long-wool breed at some time subsequent to its foundation. Saxony developed a small and rather delicate type of Merino with a wool of finer quality than was ever produced in Spain.

Merino Ram

For hundreds of years and in many countries the Merino has been the most powerful influence in the breeding of fine-wool producing sheep.

Photo:
Director of Informatisn, South Africa House, London.

Game Birds on the Farm (Article on pp. 270–3)

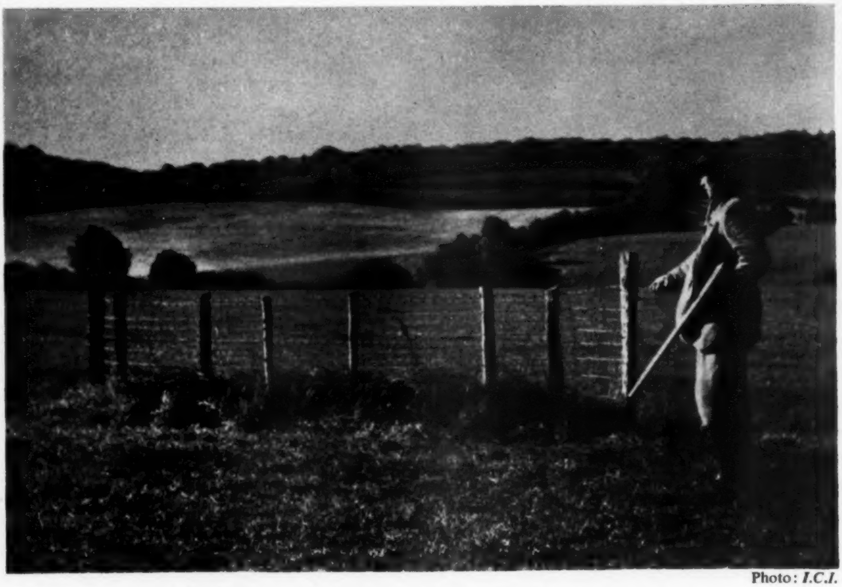


Photo: *I.C.I.*

Partridge nesting cover provided in a small area protected from grazing by a barbed wire fence.

Photo: *C. M. Horsey.*

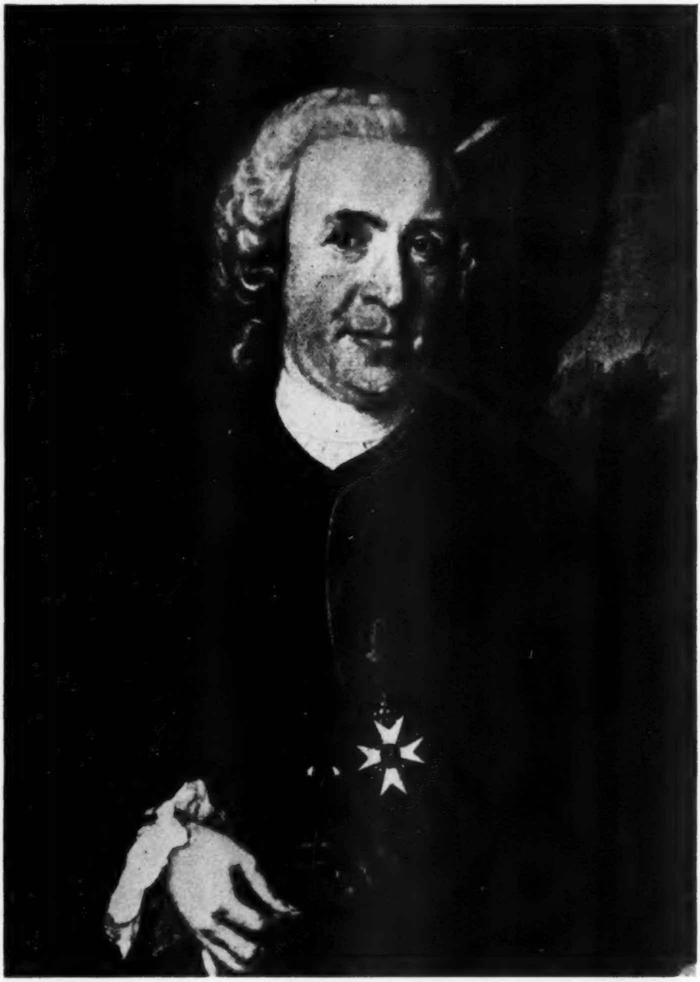
Young pheasants reared in a normal poultry-brooder.

Ways with Stock at Thurgarton (Article on pp. 283–6)

Close-penned, polled animals at Thurgarton fed out at twenty months old.

Photos: *Boots Pure Drug Co.*

A thorn hedge providing shelter for a calf paddock.



LINNAEUS, 1707–78

The 250th anniversary of the birth of Carl Linné, the great Swedish naturalist, was celebrated last May. The binomial system of naming plants, which he introduced, has remained unrivalled—a telling tribute to his genius.

(*Article on pp.* 279–82)

The Merino comes to Britain

The history of the introduction of the Merino into Britain is of particular interest, since it is seldom realized now how extensive and prolonged the breeding of Merino sheep in this country once was. There are no Merino flocks in Britain now, apart from a small flock recently introduced for research work on wool production. Yet not so very long ago, there were many Merino sheep and several noted pedigree Merino flocks in England and Scotland.

There are unsubstantiated rumours of the importation of Merino sheep into England in Elizabethan times, but the first definitely recorded importations were in the time of George III. Following a small importation of some 40 Merinos into England in 1791, there was a much bigger one of some 2,000 in 1808. Merinos became fashionable, and a Merino Society was founded in England in 1811, under the presidency of Sir Joseph Banks.

The Merino is essentially a fine-wool producing breed. It is kept for no other purpose, and there can be no doubt that the Napoleonic wars and trade disruption had much to do with its early success in England. The great woollen textile industry here required its raw product in abundance; the Merino sheep introduced into England could supply that product in its finest and most valuable form. Therefore the rapid expansion of the breed throughout England promised a satisfying combination of patriotism with profit.

The end of the Napoleonic wars in 1815 and the resumption of normal trading relations with Europe altered the whole pattern of the sheep industry in England. Wool could be imported; meat, other than salted meat, could not, there being no satisfactory method of meat preservation until refrigeration became practicable about the year 1880. Consequently, the sheep industry of England specialized in supplying meat for the rapidly increasing industrial population. Fine wool production and the Merino sheep were left first to Saxony and later to Australia.

Nevertheless, there were several fine flocks of Merino sheep to be found in England far into the nineteenth century. As late as the 1860s Australian flockmasters were buying stock from these English Merino flocks, of which one of the best known was the Dorrien flock at Ashdean in Sussex. The competition, however, first of Saxony Merino wool and then of Australian Merino wool effectively stifled the development of commercial Merino wool production in England. There is no real evidence—despite many commonly repeated assertions to the contrary—that the English climate or sheep husbandry systems were in any way unsuited to the Merino sheep or to the production of Merino wool of the finest quality.

Not a breed for Scotland

In Scotland the Merino was introduced, tried, and found wanting for a rather different reason. To make the best use of the grazing which the Scottish hills provide, it is essential that the sheep scatter out or "lie abroad" as the old shepherds put it, this habit gradually developing into the "hefting" system by which each area of the hill is inhabited and grazed by the family group or "heft" of sheep that are native to it.

Merino sheep will neither "lie abroad" nor will they "heft". The breed is

gregarious, moving over the ground in one close flock, an instinct that has proved of great value in new countries where shepherds were few and predatory animals abundant. They were quite unsuitable for the type of very unequal grazing which most Scottish hills provide.

Patrick Sellar[4], who tried out the Merino extensively in Sutherlandshire, recorded this objection in *The Farmers' Magazine* in 1820:

> Owing to the disposition of the Merinos, they are not suitable to these wastes of peat-bog, not that they do not thrive and yield wool in abundance and of the first quality, but that as three-fourths parts of the wastes consist of Alpine plants which they reject, the same quantity of Sutherland ground will keep three hundred Cheviots that will maintain one hundred Merinos . . .
>
> They range all in one lot—that is, of whatever number the flock or hirsel consists, it is found all in one place, feeding like a drove passing through a country; and they are either on one of the spots of fine grass in the mountains or travelling from one of these to another.

To summarize the history of Merino sheep breeding in Britain, it would seem that the brief period of its relative popularity at the beginning of the nineteenth century was connected with the interruption of normal trading relations with Europe during the Napoleonic wars; that its rapid decline was due rather to the cessation of those wars than to any unsuitability of British climate or soil to the production of fine wool. A further reason for the disappearance of the Merino from the long list of British sheep breeds is that the Merino is a fine-wool producing sheep and nothing more, and that with the growth of the industrial population of Britain during the course of the nineteenth century the future of the British sheep industry came to depend upon mutton rather than on wool.

But in Europe the breeding of Merino sheep lasted longer than in Britain. In Saxony especially it reached a degree of specialization in fine wool production beyond anything achieved in the breed's native Spain. It is probably true to say that never before and never since has wool of such superlatively fine quality been produced anywhere in the world nor from any breed of sheep, as was grown by the Saxony Merino under the almost grandmotherly care of the Saxon shepherds. It is recorded that the flocks were brought under cover at the merest threat of a shower of rain! Saxony Merino sheep breeding was both intensive and expensive and, despite the high quality of the product obtained, was unable to compete in the world's markets against the much more cheaply produced Merino wool flooding in from Australia.

The Merino in Australia

The possibilities of Australia as a continent particularly suited for fine wool production were first publicly announced by Captain McArthur in a memorandum submitted to the British Government in July, 1803. He wrote:

> Captain McArthur considers it his duty respectfully to represent to his Majesty's ministers that he has found, from an experience of many years, the climate of New South Wales is peculiarly adapted to the increase of fine-woolled sheep, and that from the unlimited extent of luxuriant pastures with which that country abounds, millions of those valuable animals may be raised in a few years, with but little other expense than the hire of a few shepherds.

McArthur's prediction has proved abundantly true, for despite droughts, depressions, dingoes and rabbits, Australia has become the premier Merino

sheep country of the world. The Australian Merino of today has, of course, diverged considerably from the Merinos of old Spain and of a more modern Saxony, not only by selective breeding but also, it would seem, by the introduction of the blood of certain English sheep breeds.

The most popular strain of Australian Merino today is the "Peppin" strain, and it is fairly certain that an English longwool cross was used in the evolution of that strain. Again, the French Rambouillet was freely used in building up the modern Australian Merino, and Austin[6] has produced circumstantial evidence that an English longwool cross, probably a Leicester cross, was used at Rambouillet somewhere about the year 1830.

Two modern derivatives of the Merino, namely, the Polwarth and the Corriedale, are admittedly the result of crossing the Merino with English longwools, especially the Lincoln. The Polwarth was formed by mating Lincolns with Merinos followed by a back-cross of the half-bred progeny to the Merino and subsequent inbreeding. The Corriedale, whether New Zealand or Australian, is essentially an in-bred cross between the Lincoln and Merino.

The general result of this infusion of English longwool breeds into Australian fine-wool flocks is a heavier fleece and therefore more wool, but wool probably considerably less fine than was grown by the original Merino sheep of Spain and certainly less fine than the Merino as developed in Saxony. There can be no doubt, however, that the development of a heavier fleece of less superlative fineness was economically sound and, under modern conditions of woollen textile manufacture, has paid the Australian wool producer extremely well.

In both New Zealand and the Argentine the Merino played an essential part in the early development of a prosperous sheep industry. But in both countries the possibilities of an export trade in mutton and lamb opened up by refrigeration led to the introduction of English mutton breeds of sheep and the relegation of the Merino to a less important economic position.

It is, indeed, in countries such as Australia and South Africa, in areas climatically unsuited to meat production, that the Merino chiefly prevails today. In discussing the future of the sheep and wool industry, Mellett and Hambrock[7] prophesied that the Merino would eventually come to be restricted to regions suitable only to extensive farming under semi-arid conditions, and that gradually it would be replaced by cross-bred sheep and cattle, as an ever-increasing human population compels general intensification of world agriculture. That day, however, is not yet and the Merino sheep, the pride alike of ancient Spain and of modern Australia, remains and, so long as the present high price of wool persists, it will remain the most valuable and important breed in the world's sheep industry.

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Fairfield

G. F. SHEARD, M.SC.
Director

FAIRFIELD Farm was bought in April 1950 and established as an Experimental Horticulture Station to deal mainly with glasshouse crops and serve the north Midlands and northern England. The station also undertakes work on outdoor flower crops and soft fruit on a limited scale. It is situated in the central Fylde area of Lancashire, close to the main glasshouse areas adjoining the Ribble estuary—Marton (Blackpool) to the north and Hesketh Bank and Southport to the south.

The station is within the western coastal good light area and has the advantages of good winter light, little fog and freedom from atmospheric pollution, which are most important for crop production under glass. It is, however, very exposed to westerly winds, which cause damage to outdoor crops, increase the heat loss from glasshouses and, on occasion, cause structural damage to glasshouses and buildings. Attention is being paid to the provision of shelter-belts and windbreak hedges, but their size and depth is limited by the size of the station, which covers 22 acres. Rainfall is moderately high—an average of 36 inches a year. The soil is a light to sandy loam overlying a reddish, sandy, boulder clay (typical of the Fylde), which impedes drainage at depths of 18–24 inches and adversely affects the growth of some soft fruit.

Glasshouse design and construction

Glasshouse building began in 1952 and work on the design and construction of glasshouses has been incorporated as the various units have been built. So far, improved light transmission, durability of hardwood and softwood timbers, methods of timber preservation and the elimination of internal obstructions have received attention. Most of this work is a long-term task, but work on the design of propagating-houses to give improved winter light has already given definite results of value to the industry. Houses orientated east and west are much better illuminated in winter than those running north and south, and in areas of good winter light a steep, south-facing roof section will minimize reflection and increase transmission of low-angle winter sunlight.

Houses of improved design are no more expensive to build and give as much as 50 per cent better growth compared with houses of conventional design. The high cost of building has stimulated efforts to reduce the quantity of materials used and the cost of site works, by increasing prefabrication. In the near future it is hoped to test an aeroplane-type glasshouse in which factory prefabrication promises to lower the cost by about 20 per cent. Comparisons are also being made between identical glasshouses built in timber and in light alloy.

Better heating systems—smaller fuel bills

Heating is the second largest item of expenditure in producing crops under glass, and it accounts for 25–30 per cent of the cost of growing tomatoes. With the continual increase in the price of fuel, heating costs are a major problem in the industry, and in collaboration with the National Institute of Agricultural Engineering, the station is carrying out a programme of work to reduce this item by improving boiler efficiency and providing better heating systems. Work at Fairfield is confined to solid fuels, but a similar exercise on oil is being carried out concurrently at the Efford Station. Three types of automatic stoker, the underfeed, the chain grate and the front attachment stoker, are being compared with hand-firing. Hand-fired boilers have been clearly shown to be high in operating cost and low in efficiency. Automatic stokers increase boiler efficiency and save money which quickly offsets the capital cost. The chain grate is of particular interest, as it will burn cheap, low-grade fuels at a high efficiency and, under our conditions, provide the cheapest form of heat.

Ten glasshouses on the station are heated by low pressure steam; they are 150 feet long, and in houses of this length, steam heating produces a marked temperature gradient when operated under thermostatic control. This gradient is caused by the characteristics of steam flow in unlagged pipes, and studies have been made of the effect of pipe material, inlet size, steam pressure, pipe arrangement and independently controlled end loops on the gradient. By using looped pipes and independent end loops, it is possible to reduce the gradient appreciably. During 1957–58, four houses will be fitted with a high velocity hot water system, using small diameter pipes to reduce the gradient further, and to test a low pressure steam injector developed by the N.I.A.E. This new equipment offers a cheap method of combining the advantages of steam for generation and transmission, and hot water for the dispersal of heat in the houses.

Though more efficient heating systems are being rapidly developed, it must be remembered that the industry cannot change quickly from the commonly used 4-inch hot water system because of the capital invested, the low, second-hand value of the pipe and the high replacement cost. As an interim measure, work is being carried out to improve 4-inch systems at reasonable cost by the use of mixing-valves and improved pipe layout. This should reduce heat wastage and give better temperature control.

Glasshouse temperature and watering systems

Temperature has a marked effect on crop growth and development and with tomatoes can greatly affect the yield and quality of the early fruit. Studies are therefore being made of glasshouse climate in relation to the tomato plant in an effort to determine the correct conditions for producing high quality and yield. This work is linked with that on heating systems, particularly in respect of the position and arrangement of the heating pipes as it affects the uniformity of temperature distribution.

To get close control over the growth of the crop and reduce the labour demand in summer, investigations have been made on water requirement and

liquid feeding. The water requirement of a glasshouse crop varies with the weather and can be calculated from measurements of the incoming solar radiation. Calculated water requirement has been applied through an automatic watering system and found to agree closely with the actual requirement. Water was applied in the first experiments using drip nozzle irrigation systems, but though they gave good distribution, we had considerable trouble on our soil with nozzle blockage. In recent experiments we have substituted the low-level sprinkler system developed by the N.I.A.E. and find that it gives very little trouble from blockage, works well on a wide range of soils and gives a better distribution of water in the borders than drip nozzle systems.

Where automatic watering systems are used, it is necessary to apply fertilizers with the water. Soluble fertilizer materials are made up into a concentrate and fed into the main water flow through a dilutor. Our results have shown that a grower can make up his own concentrate from readily available materials at reasonable cost. It is desirable to feed the fertilizer at a constant dilution with every watering, so that the crop gets feed in relation to its water requirement. The best dilution is about 1 lb of fertilizer in each 100 gallons of water. It has been shown that liquid feeding gives a more efficient use of fertilizers, a better control of growth, a saving in labour, and help where high salt concentration is a problem.

Disease: Steaming: "Clean air"

Over the past six years the station has maintained a continuing trial of tomato varieties. The first years covered mildew-resistant varieties, and search was made for varieties resistant to the very virulent strains of *Cladosporium* found in Lancashire. These trials showed the marked superiority of the varieties Antimold A and Antimold B, bred by the John Innes Horticultural Institution. More recently, attention has been turned to F_1 hybrids; of those tested, the variety Ware Cross stands out in its ability to combine earliness, high yield and quality.

Lettuce is a very important crop in Lancashire, and our work has confirmed the economic advantages of the close spacings used and the increased productivity and better stand obtained by using soil blocks. Work is in hand to try to find control measures against *Botrytis* and tip burn. Cheshunt 5B and Cheshunt Early Giant are the two varieties most widely grown under heated glass, but the industry is always looking for better and earlier-maturing varieties to replace them. The station has developed three selections which show distinct improvement on 5B, and one of them is highly resistant to tip burn.

With higher costs for fuel and labour, steaming has become increasingly expensive. Following research on the steaming process by the N.I.A.E., the station has developed equipment and demonstrated methods of reducing the cost by controlling the soil moisture content, by controlling the rate of steam injection into the soil and by the use of plastic covers to reduce steam loss. Last winter an automatic plough-type steaming grid was tested. This gave efficient sterilizing and cut the labour cost by about 50 per cent.

Many growers are finding it impossible to comply with the requirements of the Clean Air Act, 1956, as regards the emission of black smoke from

boilers. Work has been carried out on the control of smoke emission from loco-type boilers, the results of which will help growers to overcome their difficulties. The most promising solution to the problem is the fitting of a small, forced draught fan to a sealed ashpit to enable coke or coke breeze (both smokeless) to be burnt efficiently.

Flowers and fruit

Work on flower crops is limited at present and has been mainly concerned with chrysanthemums. Experiments have been conducted on methods of propagating early-flowering varieties and on flower production from summer-rooted cuttings of mid-season and late varieties. Variety observation trials have been established for early mid-season and later flowering chrysanthemums, dahlias, pyrethrums, peonies, *Chrysanthemum maximum* (Shasta Daisy) and scabious. With pot plants, trials are being made of the effect of pot size, depth of corm, strength of compost and method of feeding cyclamen.

Fruit experiments have been confined to the National Fruit Trials soft fruit varieties, including black currant, gooseberry, red currant, raspberry and strawberry. With the exception of strawberry and black currant, the trials have been disappointing. Raspberry and gooseberry varieties suffer seriously from wind damage and impeded drainage and are proving difficult to establish. Black currants also undergo damage by wind but produce an economic crop. Strawberries do well; it is interesting to note that up to the mid-1920s, when Red Core became a problem, the Fylde was an important strawberry area, and it is likely that work in the future will be concentrated on this crop.

Couch and its Control

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Whatever the farmer means by "couch" (and there are many local names for these troublesome weeds), control rests upon good husbandry and chemical spraying.

THE term "couch", like the weed itself, is ubiquitous. It is not always used in its strict botanical sense, and in everyday speech it does duty to cover all those perennial weed grasses that spread rapidly by means of runners (rhizomes) just below the soil surface. But there are many other names in various parts of the country—scutch, squitch, twitch, wicks, wickens, quick-grass, windlestraws, and wizzards being but a few of them. It has been said with some truth that couch-infested land is "almost synonymous with bad farming", and certainly the presence of couch is usually due to neglect; the normal practices of clean husbandry can prevent serious infestation. Couch is spread both by the seed and the rhizomes: unclean seed and unrotted manure can spread it, and during the summer rhizomes may run out into the headlands, whence, by later cultivations, the weed can be distributed to other parts of the field.

Control can be achieved by cultural or chemical means. Cultural means include ploughing, fallowing, removal and burning of the rhizomes, rotavating, and changes in cropping; the chemicals available at present are sodium chlorate and trichloracetic acid.

A number of different species of grass qualify for the collective name of couch; the most important of these are *Agropyron repens* (L.) Beauv. (the true couch), *Agrostis gigantea* (Roth.), and *Agrostis tenuis* (Silth.). (The latter two are sometimes given the distinctive titles of watergrass, black twitch or black bent* to distinguish them from the true couch.) Other species of *Agrostis* (*A. canina* and *A. stolonifera*), which creep by rhizomes or stolons ("stolons" are creeping stems like rhizomes but they remain *on* the soil surface), are also looked upon as couch or watergrass if they occur in arable land. A further species is *Arrhenatherum elatuis* (L.) J. & C. Presl., the tall oat grass. This is variable in form, but when the base of its stem forms a chain of swollen corms it is recognized as onion couch. It has no rhizomes and is quite distinct from other forms of couch, with which it need never be confused; and it is seldom called "couch" without the addition of the qualifying word "onion".

The rhizomes of *Agropyron repens* are long and fleshy, about the thickness of coarse string, sharply pointed and white when young, tending to turn grey or light brownish later. They bear scale-like leaves and roots at the nodes, and each node is capable of sending up a new shoot. In arable

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* *Alopecurus myosuroides* (blackgrass) is also sometimes called black bent.

land, due to the effects of cultivation, the rhizomes may be found up to 6 inches or more below the soil surface, but where an infestation has been left undisturbed for some time they tend to be confined to the top 2–3 inches of soil. The first leaves produced in spring are generally covered on the upper surface (particularly at the base) with many fine hairs; and these also occur on the stem (or more properly the leaf sheath), making the plant look quite downy. As the season progresses, each succeeding leaf tends to have fewer hairs. Thus later leaves may have only a few longish fine hairs on the upper surface, or they may even be devoid of them. At each side of the base of the leaf where it joins the leaf sheath are two tiny claws (auricles) which clasp the stem. These vary in size and are sometimes almost absent. The mature plant may be anything up to 3 feet high. The ears of flower-heads are superficially like those of perennial ryegrass, but the flat, 3–5 flowered spikelets which are arranged alternately along the flower-stalk (rachis) have their flat sides and not their edges facing one another from opposite sides. *Agropyron repens* is not a profuse producer of seed which is often retained in the ear after ripening. Seed can remain viable in the soil for three or four years, and a single seedling may in a season produce a patch of couch up to a foot wide. This species is found in all types of soil.

Agrostis gigantea and *A. tenuis* are similar species which are generally not such vigorous growers as *Agropyron*, although they can sometimes be almost as troublesome, especially in moist situations. The rhizomes are thinner and creep only just below the soil surface, and the leaves have no hairs or auricles. The flower-heads consist of fine branches arranged in clusters at intervals along the rachis to form the elegant panicles that are typical of bent grasses—that is, *Agrostis* spp. They are rather more profuse seeders than *Agropyron repens* and spread both by seeds and rhizomes.

Onion couch (*Arrhenatherum elatius*) is characterized by its corms, which are solid, roundish, and the size of a small marble. Several corms are often attached in a short chain, but they are readily broken apart and distributed by cultivation implements. They are capable of withstanding long periods of drought. Each corm can produce a new plant. The leaves are with or without hairs on the upper surface and have no auricles. The mature plant is usually tall—up to 4 feet—and the flowers are in large panicles 6–10 inches long, which lean slightly to one side and spread out at flowering time. The seeds resemble those of a small oat.

Control by deep ploughing and fallowing

The methods of cultivation required for the control of the different species are basically the same. The rhizomes of *Agropyron repens* buried to a depth of 8 or more inches are incapable of sending up a shoot to the surface, and if left there will ultimately die. The same is true of *Agrostis* species, although they are probably unable to reach the surface from shallower depths. Thus deep ploughing can be effective in killing-out the weed. There is a little evidence to suggest that onion couch can also be controlled by deep ploughing. To ensure that all rhizomes are below 8 or 9 inches, ploughing up to 12 or 15 inches may be necessary. It is, of course, important that the rhizomes should not be brought to the surface again during subsequent cultivations.

Fallowing is still adopted as a means of cleaning heavy land, but a fallow is really effective only when weather conditions are good. The aim is to dry out the soil in order to desiccate and kill the couch. Ploughing should be deep enough to get under all the rhizomes, and the land should be set up in large blocks which will be baked out by the sun. This is not feasible on light soils, where the soil would quickly break down to a tilth. Here a half-fallow is more likely to be taken and the rhizomes worked to the surface for collection and burning. But the collection of rhizomes may not always succeed in eradicating couch because of the difficulty of removing *all* the pieces of rhizome. The method may be worth while on headlands to prevent the spread of couch into the field. Fallowing is less effective on onion couch because the corms can withstand considerable periods of drought. Nor, since they break apart so readily, is it easy to collect all the corms from the land.

Frost may kill couch rhizomes, and it can be worth while to cultivate the stubble after harvest to bring the rhizome to the surface to remain there throughout the winter.

Control by rotavating

The most interesting recent development in the control of rhyzomatous species of couch is the use of the rotavator. It is generally believed that if couch rhizomes are cut up, each piece will establish a new plant, and that cultivation implements having a cutting action will, therefore, only make matters worse. Under some conditions this can be true, and it has already been noted that the removal and burning of rhizomes may fail to give a really satisfactory control because of the reinfestation from remaining pieces. A cut piece of rhizome, however, dies back from each cut end and one or more of the nodes which are capable of giving rise to new plants may be killed. Sometimes the piece of rhizome will die completely, particularly if it is short; and Fail[1] has shown that, because of this behaviour, persistent rotary cultivation can completely eradicate couch infestations. This characteristic of the cut rhizome may also explain why carting and burning sometimes fail, because here the aim in working the land is to avoid breaking up the rhizomes so that they can be forked together more readily.

Fail's experiments with the rotavator showed that, at a working depth sufficient to get below all the rhizomes, two to six rotary cultivations can eradicate the weed. The initial rotary cultivation should be carried out in first gear to chop up the rhizomes into the smallest possible pieces, because subsequent cultivations in the loose soil are not likely to cut the rhizomes much more. The interval between cultivation should allow regrowth of some 2–3 inches above the soil surface—generally a matter of some two or three weeks—and cultivations should be repeated until the couch is completely killed. More cultivations appear to be required on heavy than on light soils.

All species of couch are rather intolerant of treading and grazing by livestock, particularly *Agropyron*, and infested arable land can be cleared of the weeds by putting them for a few years under a well-managed grazing ley.

Control by chemicals

The two chemicals at present used to control couch are sodium chlorate and trichloracetic acid. Sodium chlorate may be applied at the rate of about 2 cwt per acre in the autumn and the land sown to crops, after an interval of four to five months, in the spring[2]. Some crops are more sensitive to chlorate than others—oats, vetches, peas, and potatoes are relatively tolerant, but the effects of an autumn application of 2 cwt sodium chlorate may be seen in spring crops of barley, mangold, beet, and turnips if sufficient leaching of the chemical from the soil has not occurred during the winter. In the development of the use of trichloracetic acid it was shown that split applications of the chemical combined with cultivations gave the best results, and when this technique is used with sodium chlorate the dose can often be satisfactorily reduced by half or more.

The total dose of trichloracetic acid recommended[3] is 40 lb of the sodium salt (the form in which the chemical is sold to farmers) in the autumn, or 30 lb in the spring. The land should be cultivated to bring the rhizomes to the surface and half the dose sprayed on the land in 20, or preferably more, gallons of water per acre. This should be followed by one or two light cultivations and then four to six weeks later the whole treatment, including the cultivations, repeated so that the full dose has been applied. In spring a single spray treatment with cultivations is often little inferior to a split application. Following an autumn application, normal cropping may be resumed in the spring—except on some fen soils and soils high in organic matter, where a spring cereal crop should not be sown. Following a spring application, rape, kale, turnips, and linseed may as a general rule be sown a month after the final spraying, and peas, beans, sugar beet, and potatoes two months after. Under favourable conditions both sodium chlorate and trichloracetic acid can give a 95 per cent or greater kill of *Agropyron* and *Agrostis* spp., although *Arrhenatherum* is not quite so readily controlled.

Other chemicals which are being investigated for the control of couch are dalapon, maleic hydrazide, and amino triazole. Initial results indicate that dalapon is particularly promising—and these chemicals will form the subject of a later article.

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2. *Weed Control Handbook 1957*. Pub. Brit. Weed Control Council 1957, 89.
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Month in the Forest

J. D. U. Ward

Seeds—Oak-sickness—Extraction-damage—Rabbits

THE end of September is also the end of the forest year, but the date for a year's beginning or end is, in a sense, arbitrary, and during this month some people will be making a fresh start by sowing their newly-gathered ash seed. Ash is peculiar in that it will grow in either of two quite different ways—either at once if sown when gathered green, or after a delay of about eighteen months if stored, stratified, in pits. Incidentally, I suspect that this characteristic also holds good for some lowlier plants such as fritillaries and certain tulips and lilies. Tree seeds which usually need to be kept two winters include hawthorn, yew, holly, lime (or linden), and some "sorbs" (trees of the mountain ash and whitebeam family). Seeds are difficult things and it is foolish to make cocksure statements about what they will or will not do. It seems highly probable that the germination prospects of many tree seeds are much improved by passage through a bird, but for others that process means death.

September is too early for actual planting, but is just right for clearing, cleaning, fencing, and settling an area in readiness for planting any time after October 20.

The other day I went to a forest meeting and we walked some private woods, where I soon found myself in that state of depression which is, alas, all too often induced by typical English woods. In one or two places where patches (say two to four acres) of old broad-leaved woodland had been clear-felled, the land had been replanted with Norway or Sitka spruce. This land, the forester stated, was oak-sick. (That assertion always causes one or two eyebrows to be raised.) But even if one endorses the oak-sickness diagnosis, surely there are possibilities other than the planting of Norway and Sitka spruce on reasonably good base-rich soils at elevations below 300 feet! Why not use sweet chestnut and sycamore, thuya, larch, and Norway maple? Spruce will grow on poor, marginal land and difficult sites: even in England they can be found on badly-leached soils at an altitude of 1,200 feet. The spruces are valuable and magnificent trees for much State and similar forestry, but surely neither kind is proper as the main, or sole, species in a fairly rich old woodland soil.

Oak-sickness, as already hinted, is an idea that some foresters won't accept. But whatever the truth may be, a man should not allow himself to be persuaded into planting oak (or ash) on doubtful sites. Oak and ash are greedy and fastidious species if they are to thrive, and there is already far too much of both on soils not good enough to produce the best timber—the only grade that pays. The countryside is cluttered up with third-grade oak that will barely pay for felling and extraction.

Another feature of these recently-visited woods was the overgrown hazel

coppice (such as I have mentioned before), neglected and allowed to grow to an age when it was good for almost nothing, and could scarcely be expected to pay for clearance. But one must be chary of allotting blame. What are, or have been, the finances of the estate? How long have the woods been under present management, and what were they like when the present manager took over? What local markets are there? The answers to these questions, and such factors as the owner's attitude towards forestry and shooting (often the order is reversed!), provide the all-important background against which many depressing woods must be viewed and considered.

In some estates near industrial areas the theft, or liability to theft, of Christmas trees (which usually means the tops not only of Norway spruce and Douglas fir, but also of Sitka spruce and Scots pine) encourages a forester to high-prune all conifers growing within two or three chains of the roads. As I heard one man remark last summer, "The trees have a better chance if thieves have to bring their own ladders!"

Much of the damage done to standing trees during the extraction of thinnings is quite unnecessary. With a little care and intelligence the barking of standing trees just above ground level can be much reduced. There are two main, basic reasons for mischief of this kind. In England, trees are not generally seen as objects worthy of care and are certainly not regarded as valuable property vulnerable to damage. And the tractor-driver, three times out of four, has no interest in the condition or composition of the woods and will probably never have cause to revisit them once his particular job is finished. At the same time, it should be noted that the extraction of selection-felled timber with minimum damage to the standing survivors can be a tricky business, and the use of inexperienced labour may well prove costly, reducing the profits from the felled trees.

The gradual return of rabbits in many places is worrying foresters. Among farmers there is a sprinkling of blacklegs—men who "don't much mind a few rabbits", or have so warm a love for their guns that they are in sympathy with those shooting men from the towns who selfishly ignore larger interests and wish to see rabbits back almost everywhere. I have not yet met a forester with the faintest taint of this virus: in forestry, rabbits are "100 per cent pest" and nothing can be said in their favour. One of their worst faults is their preference for any man-planted tree. If you are improving a small, thinly-stocked patch of wood by putting in a few small trees, those are the ones the rabbits will attack, even if there are only 50 hand-planted stems among 500 that were self-sown.

THE MINISTRY'S PUBLICATIONS

Since the list printed in the June 1957 issue of AGRICULTURE (p. 137), the undermentioned publications have been issued.

MAJOR PUBLICATIONS

Copies are obtainable at the prices quoted from Government Bookshops or through any bookseller.

BULLETINS

No. 5 Fruit Tree Spraying (*New January 1957*) 3*s*. (3*s*. 2*d*. by post)
No. 48 Rations for Livestock (*Revised May 1957*) 5*s*. 6*d*. (5*s*. 11*d*. by post)
No. 92 Chrysanthemums (*Revised January 1957*) 4*s*. (4*s*. 3*d*. by post)

TECHNICAL BULLETINS

No. 2 Laboratory Methods with Plant and Soil Nematodes (*Revised January 1957*) 3*s*. 6*d*. (3*s*. 9*d*. by post)

OTHER PUBLICATIONS

Fatstock Guarantee Scheme 1957–58 (*New March 1957*) 2*s*. (2*s*. 2*d*. by post)
Smallholdings organised on the basis of Centralised Services: Land Settlement Association Report and Accounts 1955–56 (*New June 1957*) 2*s*. (2*s*. 2*d*. by post)

LEAFLETS

Up to six single copies of Advisory Leaflets may be obtained free on application to the Ministry (Publications), Soho Square, London, W.1. Copies beyond this limit must be purchased from Government Bookshops, price 3d. each (5d. by post).

ADVISORY LEAFLETS

No. 438 Clotted Cream (*New May 1957*)
No. 460 Stem and Bulb Eelworm on Narcissi, Hyacinth and related Crops (*New July 1957*)
No. 463 Winter Grass (*New June 1957*)

FIXED EQUIPMENT ON THE FARM LEAFLETS

No. 15 Shelter Belts for Farmland (*Revised June 1957*) 1*s*. 3*d*. (1*s*. 5*d*. by post)

FREE ISSUES

Obtainable only from the Ministry (Publications), Soho Square, London, W.1.

FARMING TOPICS

No. 13 Higher Returns from Grass (*New March 1957*)

MISCELLANEOUS LEAFLETS

First Aid in Agriculture (*New June 1957*)
Grower's Guide to Deficiency Payments on Wheat and Rye (*Revised June 1957*)
National Pig Records—Your Questions Answered (*New July 1957*)
Survey of Bee Health and Beekeeping in England and Wales 1956 (*New May 1957*)

Farming Affairs

Talking about poultry

It seems that the ability to understand and work with figures is becoming an increasingly important part in every poultry-keeper's training. We have on the one hand a relatively simple calculation such as "how much have your pullets cost to rear", and on the other hand, the possibility of doing a complete farm analysis or costed work sheet with the object of finding the more profitable and unprofitable sections of the farm.

In the course of my work I have been interested to help to investigate both sorts of problem and, this month, I should like to spend a little time on the relatively simple estimate of the cost of rearing a pullet. At the same time, I would like to emphasize the considerable financial advantages which have been gained by farmers who have co-operated with the N.A.A.S. in a detailed farm account or management survey. I believe that the advantages and benefits accruing from the time and money spent on such work are really substantial.

If we look at much of the available literature, it will be seen that an out-of-date or arbitrary figure is often used, or the point is carefully avoided. These notes do show some figures which refer to the cost of rearing a pullet. I emphasize that these figures may not be correct, but I have put them in because they are approximately near the mark, and the all-important thing I have found when working with poultry farmers is that they should have some figures which can be compared with the results on their own farms.

	s.	*d.*
Food	10	–
% Mortality		7
Labour	1	3
Cost of chick	3	–
Fuel		4
Interest on capital		6
Depreciation on equipment	1	–

I am therefore suggesting that it is possible to rear a pullet for about 15*s*. plus your interest and depreciation charges. Now I have frequently used these figures in discussions with farmers, and my clients generally fall into three groups: those who are doing better than I suggest, those whose costs are at least 10*s*. more than I suggest, and the majority, who fall somewhere between 15*s*. and £1. The man whose pullets cost him 25*s*. each to rear will always insist that he cannot possibly do it any cheaper. Well, in this case, either his figures are right and there is something radically wrong with his methods and organization, or his method may well be right and his figures perhaps not a true interpretation of the facts. (I have, before now, found the first year's depreciation on a Land Rover written off against 150 pullets!)

For the majority of clients we could almost always make some improvement by discussion. So very often the feed cost figure just did not bear comparison and in many cases wastage, or just "don't know", accounted for the

difference, and obviously this feed cost figure is the one which has really got to be looked at.

Here then is a "cockshy", something to compare your own figures with. I would happily agree that there may be errors both in the "cockshy" and indeed in your own figures, but I am convinced that the effort of working them out and making the comparison is well worth while, and if done at this time may give you some very helpful pointers for next year's operations.

C. T. Riley

CROP PRODUCTION BY APPROVED PRODUCTS

The 1957 list of crop protection chemicals approved under the Ministry's Scheme has just been published and is, indeed, extremely valuable, containing as it does a list of approved products under chemical names, addresses of manufacturers, and a comprehensive 20-page index which lists pests, diseases, and weeds, and refers the reader to the appropriate chemical control.

New chemicals, now included in the list for the first time, are arsenical potato-haulm killers, dimefox for the control of aphids and red spider on hops, and malathion, an effective organo-phosphorus contact aphicide of a low mammalian toxicity. On the weed-killing side, there is a group for MCPB, which is a useful addition to the range of weed-killers, and which has shown its worth for the control of weeds in peas and clover.

Perhaps one of the most useful advances that have been made during the year is the agreement with the manufacturers that the content of active ingredient of MCPA and 2,4-D products shall in future appear on the labels of approved products. It should be mentioned that formulation does play some part in determining the activity of pest control products, so that it does not follow that a product that contains a higher percentage of active ingredient is necessarily more efficient. At a recent Weed Conference it was stated that a farmer would have great difficulty in assessing by eye differences in weed population of 20–25 per cent in two fields of cereals, and that weather and stage of growth of the weeds and crop are very important factors in weed control. Perhaps nothing could more clearly illustrate the importance of buying an approved product, since it is now nearly impossible for the farmer to judge for himself.

It is the aim and object of both the Ministry and the industry to produce pesticides of increasingly higher standard. It must, however, be kept in mind that purer pesticides mean more expensive pesticides when costs are compared on a weight-for-weight comparison of active ingredient. It is an expensive matter purifying chemicals, and to do this unnecessarily would clearly be absurd. There are, however, occasions when a purer product has advantages; thus it has also been agreed with the industry that the content of such impurities as chlorcresols in MCPA products shall be reduced, the reason for this being that such impurities not only give the countryside an unpleasant smell, but also have other disadvantages.

All in all, it is well worth writing to the Ministry (Publications), Soho Square, London, W.1, for a free copy of the 1957 List, which not only guides the farmer in selecting his pest control chemicals, but ensures him a high

standard of performance and gives him a chance to compare the cost of different products.

Tractor sense

Accurate steering is a mark of good tractor work. Crooked furrows and rows lead to waste of time in subsequent operations. In ploughing, if the finishing strip is not parallel-sided, time and fuel are spent in running out short ends and this puts up the cost of ploughing. In row-crops a bend in the rows causes trouble right through the hoeing season and the harvest.

When setting up a plough ridge or drawing potato ridges, or indeed in drilling the first round of corn, some kind of navigational aid is needed: there is no chance of following a previous row or markers, so sighting sticks are necessary. If the distance is short and the ground is level, two marks are sufficient, a small one on the starting point on the near headland, and a large stick to mark the finishing point on the far headland. If there is a rise of ground between the start of the bout and its end, intermediate guides will be needed.

There are several ways of keeping a straight course with the help of sighting sticks. One method is to line up a point on the tractor with two sighting sticks; another way is to use one sighting stick and a distant fixed object such as a tree; and yet another is to line up two points on the tractor, for instance the tank filler cap and the radiator cap, with a single sighting stick at the far end of the field—as long as the sighting stick and the two points on the tractor are in alignment, the path of the tractor will be straight. When a tractor has an enclosed radiator it is worth while fixing a vertical rod in the front to act as a sight.

In spite of all care, however, attention sometimes flags and the result is a "dog's hindleg" in the bout. In ploughing, where the tractor is being run with the front wheel against the furrow wall, the curves will be reproduced in every subsequent furrow. It is possible to make corrections. For example, to straighten a curve which bends towards the furrow side, steer so that the leading plough body is taking less than its full width for all the length of the furrow except alongside the bend. Bad bends may take several bouts to complete the correction.

For wide tractor drills, the use of markers is absolutely essential if the joins are to be even. The distance of the marker from the outside coulter of the drill must equal the distance between the front wheel of the tractor and the outside coulter on that same side, plus one row width. The tractor is driven so that the front wheel rides in the shallow groove made by the marker. If a track-laying tractor is to be used, fit a "sighter" to the front of it to "take the place of" the two front wheels for this purpose of sighting—a transverse horizontal strip of metal, with its ends turned down, is all that is needed.

Marking for outfits spraying ground crops is important. At the beginning of the operation, have an assistant to mark out each strip to be treated, because at first it is hard to judge the width of spray.

If ridges for potatoes have to be drawn on ground that slopes sideways, it is often worth while to draw two rows at a time with a three-row ridger, the nearside body travelling in the last furrow of the previous round as a guide,

though this does mean that the toolbar carrying the ridging bodies has to be levelled after each bout.

For inter-row hoeing, inaccurate steering can cost money directly in cutting out plants from the rows. Individual units along the toolbar should all work at the same depth to eliminate any tendency to crab, and steering must be done smoothly without quick movements. If a driver finds that he is veering to the right, his first instinct is to swing the steering wheel to the left. This would cause any tools rigidly fixed to the back of the tractor to swing to the right, so that instead of the hoes moving further away from the row, they would in fact move into it and cut out the plants. The usual kind of three-point linkage has, however, a little free sideways movement within the limits imposed by the check chains, and the effect of steering is not as immediate or drastic as it would be if the hoes were attached rigidly to the tractor; nevertheless, make all corrections gently so that the temporary swing of the tractor shall not be wide enough to cause damage.

H. J. Hine

Autumn hay on quadpods

Whatever may be the advantage to the large farmer of tripods for haymaking, I am quite certain that it is difficult to overestimate the service they can render to the smallholder, who otherwise must depend on contractors for his haymaking. Last year, on our farm in Sussex, I actually had my hay carted in October, in that short, fine, warm period of St. Luke, from which we derive, so etymologists tell us, the expression "luke-warm".

I must admit that it was my wife's idea to use tripods. Her enthusiasm had been raised by descriptions of them in agricultural journals. After deliberation, she decided to make, not tripods, but a substitute which we now always call "quadpods". They are slightly easier to make, and stand, I think, more firmly on the ground.

In spite of the continuous rain, we saved all the hay we placed on these quadpods, whereas we lost all that we tried to gather by ordinary haymaking methods. The first advantage of the system was, we discovered, that, instead of having a whole field mown in one day by a contractor, we could use our small, two-wheeled motor scythe to mow about a quarter-of-an-acre at a time. If there was plenty of sunshine the next day, the hay could be turned about midday, and by the evening it was sufficiently wilted to be stacked upon the quadpods. If there were showers, we had to turn it perhaps two or three times, but somehow, during the second day, when it was free of damp from rain, we always managed to build it on its quadpod so that none of it lay for more than forty-eight hours.

We used our mare in a milk float to cart the half-made hay to the quadpods, and as we never covered more than two quadpods in an evening, the work was not heavy.

In this way, with eleven quadpods, we were able to deal with a four-acre field in easy stages. When the field was finished we left the eleven quadpods standing like great high cocks to inspire the curiosity of the passer-by.

The rain continued, and in increasing downpours. The field remained so wet that we could not get a contractor's lorry on it to do any carting. Occasionally, we anxiously visited our great cocks, which stood at least 4 feet

above our heads, and buried our arms in them to get samples of the hay, but we were never quite satisfied with this form of inspection. We heard, with trepidation, of hay selling at scarcity prices. Would our hay turn out all right when it was carted?

At last, in the middle of October, St. Luke gave us our opportunity. Jock Baxter, who does the haymaking for a great number of smallholders in this district, turned up with a tractor and trailer—the ground was still too wet for a lorry—and we opened up our eleven cocks.

At the top of each cock there was about ½ cwt of hay which had to be thrown away, but, for the rest, in nine of the cocks the hay was perfect. Jock said that he hadn't seen any better that year. The two remaining cocks were a little dusty. This was probably because the hay had been slightly wet from rain when placed on its quadpod. We kept them back to the last so that they could go on top of the stack.

Apart from this, our experiment, or—must I say it?—my wife's experiment, was an overwhelming success. Had she actually known that 1956 was going to be a record year for rain, she could not have devised a better method of countering it.

George Winder,
Crowborough, Sussex

National Pig Records—Second Annual Report

The Second Annual Report of National Pig Records published in August shows the progress that has been made by both the individual herds recorded and by the scheme as a whole.

In every case where the national average figures for numbers and weights of pigs at 3 and 8 weeks have altered, they show an improvement over the comparable season in the First Annual Report. The older the pigs get, the greater has been the proportionate improvement. This suggests that members are already using their herd records successfully to find and eliminate faults in management.

In the summer of 1956 the national "average litter" for the first time exceeded 300 lb at 8 weeks of age. This is made up of 8·6 pigs weighing 35·8 lb each, a total of 307·5 lb.

The seasonal differences between summer and winter litters are still appreciable, but they are getting less as management is improved. These better results are being achieved at the same time as the number of members and of pigs recorded increases.

The recorded results from pigs sent to bacon factories show an average length (at 150 lb dead weight) of 790 mm and 69·9 per cent were graded "A" or better. The increase in the numbers of pigs recorded at bacon factories is from 6,600 in the summer of 1955 to 35,600 in the summer of 1956, a fivefold increase in one year.

A measure of how National Pig Records is progressing is the number of litters recorded in each half-year since its inception:

9,300—16,500—20,000—24,900.

This last figure is equivalent to recording the safe arrival of half a million pigs in a year.

In Brief

GIFT FOR BRITISH AGRICULTURAL EDUCATION

A gift of £60,000 has been made by the Frank Parkinson Agricultural Trust to Seale-Hayne Agricultural College, Newton Abbot, Devon, for the purpose of erecting and equipping a new building for male residential students.

The College, one of the foremost agricultural training establishments in the country, has long been handicapped by the lack of sufficient residential accommodation for its students. The new two-storied, centrally-heated building, which is expected to be ready for occupation at the beginning of the 1958/59 college year, will be called "The Frank Parkinson Building". It will be erected on a site adjoining the College and will be set in magnificent surroundings with extensive and beautiful views over unspoilt undulating country to the sea. There will be forty-eight study-bedrooms for students, each with built-in wardrobe, cupboard, dressing table and desk, as well as accommodation comprising bedrooms with separate sitting rooms for two members of the teaching staff.

The provision of the building has been made possible by the devotion to agriculture of the late Frank Parkinson who was an outstanding personality in the electrical engineering industry until his death in 1946. Between the wars, when British agriculture was suffering a decline in prosperity, his experience as a "hobby" farmer led him to the conclusion that Britain's overall agricultural efficiency could and should be increased by the application of business principles. To prove his point he took over and operated a number of farms totalling some 2,500 acres near Ropley, Hampshire, which, on his death, he left to the Frank Parkinson Agricultural Trust which he had set up to continue his work of helping to improve the efficiency of British agriculture and to secure a steady flow of fully-trained, keen young men into the farming industry.

The Trust administered the farms for approximately ten years but, with rising costs and values constantly necessitating the capitalization of all profits, the Trustees came to the conclusion that they could better achieve their Founder's aims by disposing of the farms and devoting the income from the invested proceeds to the benefit of British agriculture. The gift of £60,000 to the Seale-Hayne Agricultural College is the first noteworthy outcome of this policy.

EXPORT OF CATTLE TO THE CONTINENT FOR SLAUGHTER

Following the recommendations of the Balfour Committee, the Exported Cattle Protection (Amendment) Order, 1957, came into operation on August 22nd. It makes compulsory the veterinary inspection of cattle before export and prohibits the export of any cattle not certified as fit to travel. Minimum requirements are laid down for the premises where the cattle must be rested for at least ten hours immediately before shipment. These cover the provision of protection from the weather all the year round, food in racks, water, and separate detention pens for animals that are ailing or that disturb other cattle. Not more than 40 cattle may be rested together in any compartment and they must be properly supervised. Ships must not sail with the cattle if the Master expects bad weather likely to cause the animals injury or suffering.

TEN YEARS OF FORESTRY

The end of the 1956 forest year (September, 1956) saw the completion of the first decade of post-war forestry. In reviewing the achievements of the last ten years, the Forestry Commissioners report that their target acreages for replanting and land acquisition have not been reached, but they reaffirm the view that providing

a third of the country's pre-war consumption of wood from home sources is a realistic objective. The difficulty of acquiring the necessary land is one of the major problems, and it is generally felt that forestry could be introduced in many hill areas which are not being used to the best advantage at present. Steps have, therefore, already been taken to make the proposition more attractive to owners and occupiers of hill land.

Last year, 118,840,000 young trees were planted in the Commission's forests; acreages of conifer and broad-leaved trees were in the proportion of 90 and 10 per cent respectively.

Private owners and the Commission were able to exploit the absence of rabbits (due to myxomatosis), and plant without enclosing the area with small mesh netting, but a close watch has to be kept because some of the land is now being reinvaded. The campaign against the grey squirrel has been maintained and, in addition, more than 5,000 foxes have been destroyed during the year.

To quote just a few figures—at the end of last September, the Commission were managing 510 forests and there were 432½ million young trees in nurseries. Some 15½ million seedlings and transplants had been sold to the nursery trade in the preceding twelve months.

PROTEIN FOR PREGNANT SOWS

Current trials at Leeds University Farm are showing that farrowing and rearing performance of sows not having access to grass is improved by increasing the level of protein feeding during gestation and suckling. The beneficial effect of protein fed in the pregnancy preceding a second litter is still more marked.

It was known from earlier trials at Leeds that litter performance of pigs on grass was only slightly influenced by the level of protein fed, so in the present series of trials 9-months old gilts were taken off grass a month before service and kept during gestation in yards, one group receiving no protein supplement in their ration, the other, 10 per cent fishmeal. A vitamin supplement was also given to allow for the vitamins normally supplied by grass. Farrowing took place on fold units on grass.

More pigs were born per litter with the gilts receiving fishmeal, and litter losses were rather lower. After weaning, the sows were taken off grass, put to the boar, and groups fed at three levels of fishmeal: none, 7½ per cent and 15 per cent, respectively.

In these second-litter trials, sows receiving 15 per cent fishmeal in their diet produced more pigs and a higher total litter birth weight and weaned two more pigs per litter. Their litters had, moreover, as high an average weaning weight as the smaller litters from sows on the lower protein diets.

The trials are continuing for two more years, but the interim results clearly indicate the benefit which was derived from the high level of protein feeding in the absence of grass.

The value of grass for both pregnant and suckling sows is certainly high. Grass guards against possible deficiencies in the ration and gives an opportunity of cheapening meal costs because of the protein it contains.

Pig Farming

VIRUS DETECTION

A test that detects plant viruses in only 45 minutes instead of three to seven days as required hitherto has been developed at Pennsylvania State University.

The new method for early detection may have great economic importance in view of millions of dollars of damage caused by virus diseases of tomatoes, potatoes, sugar beets and other crops.

In the procedure, a 2 per cent suspension of red blood cells is added to juice extracts from either the leaf or fruit tissue of a plant. Clumping of the red blood

cells indicates virus infection, and the test has such great sensitivity that it has shown up virus invasion as much as one month before a seemingly healthy tomato plant showed any overt signs of definite infection.

Financial Times

TSETSE FLY AND ATOMIC RADIATION

Atomic radiation is the latest weapon being forged against the dreaded tsetse fly in Africa—the carrier of the cattle disease *nagana* and of "sleeping sickness" in human beings. Drugs have been developed to counteract the disease in man, but a similar safeguarding of millions of cattle in the tsetse-infested regions would be well-nigh impossible. The animal phase of the disease is much more widespread than the human, and East Africa's teeming wild game act as a reservoir from which the disease can be carried to domestic stock.

But, as reported in *Foreign Agriculture*, recent research work at Harwell on several thousand tsetse fly pupae received from Tanganyika, is being carried out to alter the genetic make-up of the males, so that they will produce only sterile offspring. As the female tsetse fly mates only once in her life, fertilization by a treated male ends her line with the first generation of progeny.

If the carrier is eliminated, the disease dies out. Fly traps, "fly boys" armed with swatters, and even aerial spraying have had little effect on the tsetse population. Indirect methods, such as the burning of brush and dead grass—have accomplished more.

If the Harwell experiments are successful, they should open up the possibility of clearing thousands of square miles for the raising of good, clean cattle.

RHABDITID EELWORMS IN MUSHROOM HOUSES

Vast numbers of Rhabditid eelworms have recently been seen on the surface of peat casings in mushroom houses in Dorset. Grouped into club-like masses or swarms, containing up to 100 individuals, they are easily seen with the naked eye.

Writing in the current issue of *Plant Pathology*, Mr. L. N. Staniland says that it has been recorded that eelworms can be carried by flies which breed in cow dung or in sewage beds, but very few flies have been found in the houses. Mites from infested compost, rather than flies, may be responsible, since they have been found bearing eelworm larvae.

The eelworms usually swarmed near doors or electric lights; they disappeared from the surface when kept in the dark. When touched, the masses collapsed and individuals adhered to the finger. There seems little doubt, therefore, that the hands of workers picking mushrooms and trimming the beds are one of the means by which the eelworms are carried from bed to bed and house to house.

Composting killed many but not all the eelworms, and peak heating of the compost gave a complete kill. Unfortunately, the houses became reinfested very quickly, due, no doubt, to the ease with which the eelworms can be spread to fresh habitats. Whether Rhabditid eelworms are to be regarded as important pests, or not, is not clear. No connection between eelworm numbers and yield has yet been established, but composts heavily infested with bacteria were those with the greatest numbers of Rhabditid eelworms.

DANGER FROM ELECTRICITY CABLES

When building your stacks, site them well away from overhead electricity cables, so that there is no possible danger of anyone on the stack coming within pitchfork distance of them. Care is also called for when moving erected elevators and high lift loaders, particularly in stackyards and fields crossed by electric cables. Similarly, danger exists in the erection and movement of metal ladders in orchards where the presence of overhead wires may be overlooked. A little foresight can save a fatality.

Book Reviews

Guide to Farm Management. JAMES WYLLIE. Vinton. 12*s*. 6*d*.

Mr. James Wyllie, after a long and distinguished career in the Provincial Agricultural Economics Service, is using his retirement to good effect by making a major contribution to the growing volume of literature on farm management.

His most recent book, *Guide to Farm Management*, is presented in four parts, all of which refer to the multitude of problems facing the farmer of today. In Part 1, he shows, very briefly, that one of the notable features of present-day agriculture is the need to acquire and apply more and more technical knowledge. A larger number of opportunities are open to farmers, and management is of increasing importance.

Part 2 sets out the points to be considered when choosing a farm and a system of farming, and emphasizes the limited scope available to the farmer with only a small acreage. It underlines the significance of the overhead or fixed costs in farming, and the importance of a high farm output in reducing these costs per unit of product. The author stresses the necessity, at present, for greater reliance on home-grown foods when he states that in pre-war years "it might be said that the prices of livestock and livestock products were geared to the prices of purchased foodstuffs". Nowadays, they are "to a large extent geared to the production costs of home-grown foodstuffs".

The main cost factor in the production of different crops and livestock enterprises, together with the points involved in selecting the crop and livestock systems, are given in Part 3. Mr. Wyllie again shows the importance of high yields in crop and livestock production because of the high incidence of fixed costs. In Part 4, the advantages of management records are discussed. These records should help both farmer and farm worker to acquire an enthusiastic interest in the farm business and to appreciate the factors which contribute to successful farming.

If, in recent years, too much emphasis has been placed on farm organization and not enough on operation, then this book will help to correct the trend, for it stresses the importance of efficient operation, and, in particular, timeliness in performing all tasks. The book is noteworthy, too, for its enumeration of the many problems constantly facing farmers, but the reader may feel a little aggrieved that he has not been given more encouragement and guidance in solving some of these problems. Indeed, the author repeatedly states that the answers to many of the problems are matters of judgment and experience.

V.H.B.

The Wheat Industry in Australia. A. R. CALLAGHAN and A. J. MILLINGTON. Angus and Robertson. 63*s*.

Economics have, of course, played a decisive part in the development of this fascinating industry in Australia, and the authors conclude that the majority of growers have done what they could, within economic limits, to maintain soil fertility.

Commencing with an introduction paying generous tribute to developments in British agriculture which have been helpful to farmers in Australia, this book gives an account of the early establishment of agriculture in Australia. Each of the main soil types is discussed in relation to the system of farming which is practised. The wheat belt depends on inter-relations between soils and rainfall. In the past, soil structure has suffered from continued cultivation of wheat, and decline in yield, soil erosion and wheat sickness are shown to be symptoms of a lowered fertility arising from a depletion of organic matter in the soil. Livestock, as well as arable land, benefit when there is an alternation of legume mixtures with cereals, for there has generally been over-grazing of permanent pastures as well as deterioration of arable soils. On the other hand, fallowing of land coupled with frequent cultivations is believed to have been one of the principal causes of soil deterioration.

Black rust, which is fortunately of comparatively rare occurrence in Britain, is a frequent cause of reduced wheat yields in Australia, and a brief account is given of the important plant breeding work on rust resistance begun by William Farrer.

Arrangements for the storage and marketing of wheat are well developed in Australia and commercial samples are graded for milling and baking quality.

There are some good photographs and diagrams and a comprehensive list of papers for further reading. Although scarcely a book for the general farmer, Callaghan and Millington have produced a valuable source of reference for all who are interested in world agriculture and in comparisons between systems of farming in Britain and elsewhere.

F.R.H.

X

Progress in the Physiology of Farm Animals (Volume III). Edited by J. HAMMOND. Butterworths. 50*s*.

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Volume III in the series designed by Dr. John Hammond to present current reviews of knowledge concerning the physiology of farm animals includes separate sections on reproduction and milk production.

Under the first heading, S. A. Asdell contributes a generalized account of *Reproductive Hormones* without, however, adequate references, particularly in respect of developments since 1951. J. A. Laing presents a well-balanced chapter on *Female Fertility*, expanding, with reference to modern developments, Hammond's tripartite conception of the subject. The chapter on *Male Fertility* is still being prepared and will be forwarded later to purchasers. *Pregnancy* is dealt with at length and in detail by T. J. Robinson, who, after describing the morphology and physiology of the developing foetus, and prenatal mortality, concludes with a useful review of practical considerations.

In the second section, A. T. Cowie contributes *Mammary Development and Lactation*, primarily in the cow, and with only brief reference to other domestic animals. The anatomy and development of the udder is well presented and there is a valuable analysis of milk removal. F. H. Dodd follows with a review of *Factors Affecting the Rate of Milk Secretion and Lactation Yields*, which is complementary to the preceding chapter and gives emphasis to management and environment. Finally, I. Johannson and O. Claesson give a systematic account of *Factors Affecting the Compositon of Milk*, also mainly with reference to the cow.

The index given in Volume III applies to the whole work. It reflects a difficulty inherent in a publication of this nature in that the same subject may be dealt with in differing degree and interpretation by various authors. Such criticism should not, however, be taken as any indictment of this most notable contribution by the editor and his designated authors to the understanding of the vital subject of animal husbandry.

T.G.B.

Insect Pests of Farm, Garden and Orchard (5th Edition). L. M. PEAIRS and R. H. DAVIDSON. Chapman and Hall (London), John Wiley (New York). 68*s*.

This is the 5th edition of the well-known book of the same title which was written by E. Dwight Sanderson in 1912; much of the text has been rewritten and brought up to date. An excellent new chapter deals with insecticide formulations, spray mixtures and application equipment, and there is a very useful series of dilution tables. Insect structure and classification are dealt with in a simple, straightforward manner. The American popular names of insects are rather strange to readers in Great Britain and it requires some effort, for example, to connect "dobson flies", "fish-flies" and "hellgrammites" with our familiar alder flies.

Natural and cultural methods of control are discussed and the importance of climatic and topographical factors is brought out; the part played by predators, parasites and the resistance of plants and animals to attacks is adequately described.

Chapter V provides a condensed but useful account of the present-day range of insecticidal chemicals. Many of the newer acaricides are also mentioned. The dangerous nature of some of our modern insecticides is stressed and a feature made of the precautions so essential in their use. Much information on wetters, spreaders, adhesives, emulsions and synergists is included, and dusts, fumigants, repellents and attractants receive some attention. Biological control and legislative action is discussed in another chapter, which also includes regulations affecting the residues of poisonous chemicals.

There are concise accounts of the more important pests of a fairly full range of crops and animals; household insects and pests of stored products are also included.

A few statements are at variance with experience in this country. For example, DDT is freely recommended for use on cucurbits, without any suggestion as to possible damage. *Myzus solanifolii* is stated to be the carrier of all the important potato viruses—yet *Myzus persicae* is only mentioned in a list of other potato aphids, with no indication of its importance as a virus carrier.

The book, which is primarily designed to serve as a textbook for Americans beginning college courses in economic entomology, could, with advantage, find a place on entomological bookshelves in this country.

L.N.S.

Proceedings of the British Society of Animal Production, 1956. Edited by I. L. MASON and G. WIENER. Oliver and Boyd. 15*s*.

The present Proceedings, which constitute the sixteenth of the series, include short, original papers, as well as those given at the Society's meetings. The volume contains nine papers which are all of practical as well as scientific interest.

A short, but very interesting, paper by Clayton on aspects of breed structure in pedigree British Shorthorn cattle, shows that the situation is quite unlike that which exists in some other breeds such as the British Friesian.

Hansson reports the result of an extensive experiment on one-egg twins to determine how far the way in which they are reared affects their growth and milk production. One group was reared on a normal level of nutrition and other groups were fed on 40, 60, 80, 120 and 140 per cent of this level. Those fed on a high level reached a mature stage at an earlier age and this applied to the age at first heat as well as to body growth. For example, although those on normal feed had their first heat at 10·4 months old, in those on 40 per cent feed this did not occur until they were 13·3 months old.

The experiment indicates that the highest milk yield is obtained when the heifers are reared on a low level up to two to three months before calving and then on an increased level up to calving. A criticism of this experiment is that since these low-plane reared heifers which were "steamed up" before calving were compared with well-reared heifers which were let down in condition before calving, it would appear that the change in feed two to three months before calving may be the cause of the difference in yields rather than the way in which the heifers were reared. Hansson states that these effects of rearing on milk production tend to increase from the first to the following lactations.

Another paper, by Robertson, Stewart and Ashton, on the progeny assessment of dairy sires for milk and the use of contemporary comparisons, should also arouse considerable interest.

J.H.

The Highland Economy, 1750-1850. MALCOLM GRAY. Oliver and Boyd. 25*s*.

The period covered by this book is one during which most parts of Great Britain moved from an agrarian into an industrial economy. The Highlands were almost unique in that they had to pass through it with practically no industry to absorb their increasing population, and with very few opportunities for their inhabitants to take part in the improved living standards which came the way of the rest of Great Britain. Their main problem during the 100 years with which Mr. Gray is concerned was to continue to produce enough for a growing population off a very limited area of land suitable for arable cultivation.

For a time the kelp industry helped to provide the answer. Fishing helped, too, and so did linen spinning. By 1810, cattle, the backbone of the Highland cash economy, were making £6 a head, compared with £2 at the beginning of the period, but as the nineteenth century advanced things went badly for the Highlands. Cattle prices were nearly halved, the price of kelp fell so low that by 1850 the industry had flickered out, and foreign competition had destroyed the spinning industry. The tragedy of it all was that during prosperity most of the increased incomes had gone into the landlords' pockets in increased rents which were not reduced as prices fell, and the potato famine deprived the Highlander of a crop which since 1790 had become his most important means of subsistence.

Mr. Gray describes these events in a most fascinating way which, to at least one ignorant Sassenach, is also most informative.

W.H.L.

Chemicals, Humus, and the Soil (Revised Edition). DONALD P. HOPKINS. Faber. 25*s*.

No one quarrels about the vital importance of soil fertility, and few doubt that orthodox farming methods are able to maintain it. There is, however, a strongly-held minority view that the widespread use of fertilizers is a dangerous practice which will eventually ruin the soil. Those who support this view believe fervently that the only way to avoid a disastrous fall in soil fertility is to rely entirely on organic manure and composts.

The first edition of this book, published in 1945, brought the case for and against fertilizers into the open, interpreting the scientific evidence in favour of fertilizers in non-technical terms, and presenting an equally clear analysis of the opposition's views.

Has sufficient new information emerged to justify the publication of a revised edition? A comparison of the two editions shows that the extensive revision which has been made to include post-war experience, both scientific and economic, so strengthens the pro-fertilizer case that the author has found it necessary to add an entirely new section, putting the reasons advanced for *more* fertilizers. Figures from recent cost studies on actual farms, collected by university and college agricultural economists, are used to illustrate the connection between fertilizer expenditure and profits from the resulting increased yields. This is a most welcome addition, for these valuable reports seldom receive the attention they deserve. The examples quoted and simply explained deal with the practical problem of deciding how much fertilizer it pays to use. Economic arguments are unlikely to convince those who are against fertilizers anyway, but anyone who reads this book with an open mind will find an impartial array of evidence in the first two sections on which to judge the issue.

Much controversy would be avoided if it were recognized that those who support the use of fertilizers are equally convinced of the importance of organic matter in maintaining soil fertility. Today, crop residues and ploughed-in grass swards make a major contribution to the soil's humus supplies. The "humus school" deserves credit for continuing to focus on the biological aspect of soil fertility, and here there is need for more research. If the challenge implicit in this book brings about the publication of new research results from the Haughley Research Trust Farm, or elsewhere, they will be studied eagerly, for there is still much to learn about humus and the soil.

S.L.

Diseases of Garden Plants. A. BEAUMONT. Collingridge. 25*s*.

In his preface, the author remarks that "no book on diseases of flowers and other ornamental plants in Britain has been published since that of M. C. Cooke on *Fungoid Pests of Cultivated Plants*, published in 1906". The probable reason for this is the formidable task of preparation. Nearly half the text of *Diseases of Garden Plants* is devoted to those ornamentals which are likely to be found in well-stocked gardens and glasshouses, so that quite apart from the author's long professional experience, much research must have been undertaken to accumulate and assess the information which lies dispersed among numerous journals, many of them obscure.

Diseases of Garden Plants will stimulate both observation and enjoyment in the keen gardener as he tracks down the disease which has given rise to the particular symptoms. To do this, he may select the relevant chapter from among those on annuals, perennials, bulbs, trees or lawns; or he may prefer direct reference to the comprehensive index.

It is inevitable that the compression of so much information in so little space has resulted in a measure of over-simplification. Therefore, the beginner should not be disappointed if he fails to arrange and identify fungi under the microscope, and he should not expect success each time he tries to diagnose a deficiency by the application of a mineral solution—two techniques which the author recommends in Chapter 1.

Chemical control of fungus diseases is rarely satisfactory, even on those plant types, such as the apple, on which much research work has been done. It is not surprising, therefore, that there is little critical information on the use of fungicides for diseases of ornamental plants. With these, advice must often be based on probability, and few will quarrel with Mr. Beaumont's adherence to the older formulations of fungicides containing copper and sulphur.

Although the novelty of the book depends on the inclusion of information on ornamental plants, chapters on vegetables and fruit are given to make it a compendium of diseases of all plant types with which the gardener is concerned. The standard of the sixty-three half-tone reproductions is generally high and these, together with the text, form a book which is unique in its appeal to all those interested in gardens.

H.H.G.

Tree Injuries: Their Causes and Prevention. H. L. EDLIN and M. NIMMO. Thames and Hudson. 21*s*.

Mr. Edlin's place as a hard-working disseminator of tree and forestry lore for the layman is well known, and in this excellent and strangely fascinating addition to his already lengthy list of books he is more than ably helped by Mr. Nimmo, a forester-photographer. Indeed, it would not be unfair to say that over half the book's value lies in the latter's 125 superb photographs of individual trees afflicted by the scores of perils which trees face everywhere. When one thinks about it, there are naturally fire and lightning and flood and frost (which damages more trees than is usually realized, and not only young ones). There are also vandals, whose carved inscriptions unfortunately get bigger as the trees grow (only education will cure them, says Mr. Edlin), animals, and of course the wind. But to all except the technical expert, this book reveals how little we know about tree troubles, about the fungus diseases and insect pests, about the strange deformities, the parasites (not only ivy), the direct and indirect mishaps that kill, maim, stunt or maul trees of all kinds.

From the grown-in iron railings and the deadly effects of industrial smog, to the technicalities of spiral grain and the rising water-table that affects the tops of the oaks outside my study window, Mr. Edlin covers everything and, after skilful diagnosis, suggests remedies wherever practicable. He really seems to omit not a single tree trouble, and has painstakingly studied even the rarest fluke of deformity, disease or disaster first, to arrive at its cause and then to suggest what can be done by human agency, not only to put things right wherever possible but also to prevent similar things happening to thriving trees. Indeed it is rather soothing to one's vanity to realize that the silent, immutable trees, so seemingly aloof, do in fact need quite a lot of human help and guidance if they are to grow properly.

Mr. Edlin leads the reader not only to tree surgery, but to a new, more confident understanding of trees and their needs. That is a rare achievement; and this is an indispensable book.

D.G.

Norfolk: A Shell Guide. W. HARROD and C. L. S. LINNELL. Faber. 12*s*. 6*d*.

To many, Norfolk means only the Broads; its other attractions are undiscovered by the tourist. Those who wish to know more of the county will find this little book an admirable guide. It is in two parts; the first a symposium on the principal features, and the second a gazetteer.

After a general description, brief notes are given on the Norwich School of Artists, Norfolk churches, Broadland and rivers. The emphasis on churches, which is carried through the gazetteer, is understandable, for East Anglia was always an ecclesiastical stronghold, and "the Norfolk countryside is dominated by church towers". But it is a pity that more attention is not paid to the major industry, agriculture, for the churches were built on agricultural prosperity. A section on the evolution of farming and a picture of present-day conditions would have completed an otherwise first-class picture of the Norfolk scene. To the agriculturist, the book is marred by grouping together Broadland and the Fens—they are areas completely different in character. Their one possible common characteristic, that they are man-made, is opposed by the authors. To say of the Broads that they "were originally an arm of the sea" is to reject modern research which points to a man-made origin by peat cutting.

However, this is perhaps carping at a guide which will delight the visitor to Norfolk. It is written in a most refreshing style and is worth more than a casual glance. Some hard things are said about the aftermath of war in the shape of derelict airfields and military holdover, and no country lover will dispute them. State forests do not escape criticism, though to the forester the serried ranks of conifers are not ugly. The map and guide key are very good.

R.B.S.

Dairy Cattle and Milk Production (5th Edition). C. H. Eckles. (Revised by E. L. Anthony). Macmillan (New York and London). 42*s.*

Dr. C. H. Eckles's book is very ambitious in scope. In fact, a brief glance at the very full "contents" page gives the impression that the author has attempted to produce an encyclopaedia of dairy husbandry. Unfortunately, although the book extends to 573 pages, including the appendix, it does not deal with all aspects of milk production in the detail which is required of a university text-book. In the past decade, agricultural research has developed rapidly, and it will become increasingly difficult to fulfil Dr. Eckles's original desire "to bring together in one book the essential information regarding the dairy cow".

At present, there is a tendency to refer to specialist volumes dealing with limited aspects of this wide field of study: for example, genetics and animal breeding, animal physiology including growth and development, nutrition, and practical dairy husbandry. It is most pleasing, however, to find an author who can successfully combine a practical and scientific approach. As a general text-book, and particularly for demonstrating the scope of the subject, this book is excellent.

From a practical farmer's point of view, the book is interesting, but as it is related to American conditions, much of the information is not directly applicable to British agriculture. The chapters describing ensilage and pasture management—two very important topics—are of limited value to readers in this country. However, many of the subjects discussed, such as the importance of cow-beef and dual-purpose breeds, the labour problems in milk production, the seasonality of herbage and forage crop production, and the difficulties involved in selecting breeding stock, are common to both countries.

J.E.D.

Books Received

Thirty-Seventh Annual Report of the Forestry Commissioners for the Year Ended 30th September, 1956. H.M. Stationary Office. 4*s.* 6*d.* (4*s.* 9*d.* by post).

Cereal Diseases in Ireland. Robert McKay. At the Sign of the Three Candles. 21*s.*

Fontana Wild Flower Guide. R. S. R. Fitter. Collins. 3*s.* 6*d.*

Modern Poultry Husbandry. Leonard Robinson. Crosby Lockwood. 36*s.*

Sheep-Shearing Experting. (Australian Agricultural and Livestock Series). L. D. Ryan. Angus and Robertson. 45*s.*

Types of Rural Economy: Studies in World Agriculture. René Dumont. (Translated by Douglas Magnin). Methuen. 45*s.*

The World of the Soil. Sir E. John Russell. Collins. 25*s.*

Dry Farming in the Northern Great Plains, 1900–1925. Mary Wilma M. Hargreaves. Harvard University Press. London: Oxford University Press. 80*s.*

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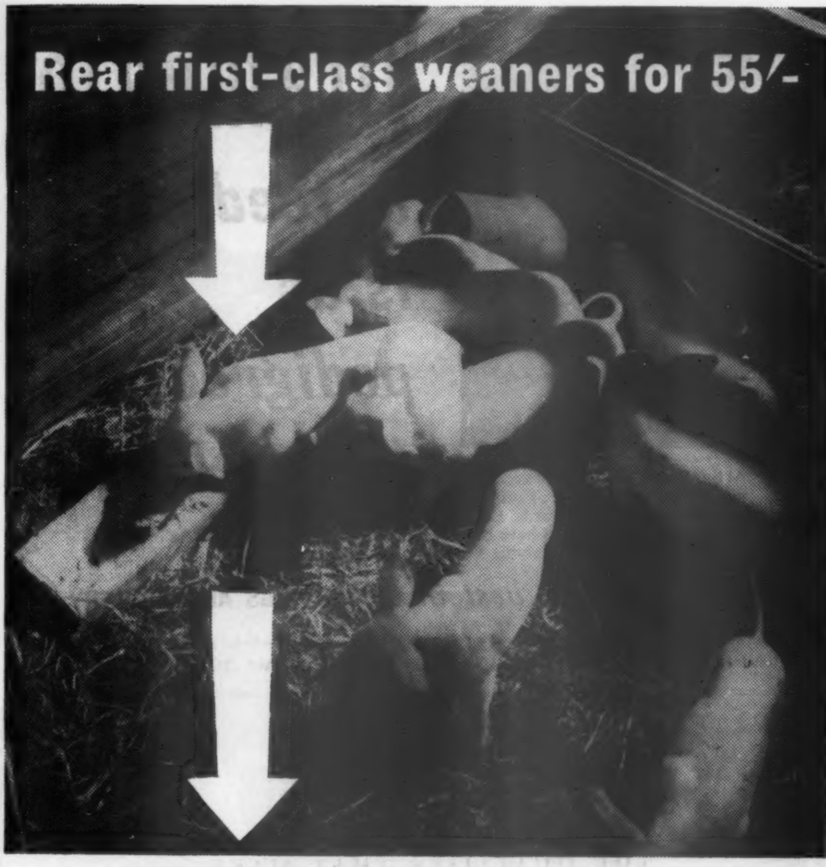

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